EDITORIAL

ACCORDING to a statement recently issued by the Bureau of Internal Revenue, the number of persons with incomes exceeding $1,000,000 per year decreased from 141 in 1917 to 67 in 1918. We should worry!

BOLSHEVISM, as we have frequently remarked, is most effectively promoted by reactionary individuals and periodicals. We quote the following, italics and all, from one of the latter. "As a matter of fact *a strike is a criminal movement.* Unions are criminal organizations because their intent is criminal, if it becomes necessary to exercise their power. Labor has the same right to organize as the other elements in society, *but not to commit a crime.* If it were not for the jellyfish spinal column of public officials, men who strike would be *prosecuted for conspiracy.*" Bunk!

THROUGHOUT this year, and particularly during December, attention is being devoted in both England and America to the hundred or so men and women that, three hundred years ago, took part in one of the most important events in American history. Detailed discussion of the virtues and the faults of the Pilgrims would be out of place here. Their most characteristic faults have been pretty well eliminated from the America of today. We wish we were as sure that their characteristic virtues had not also been well-nigh eliminated. We would like, however, to call attention to one of their qualities (we will not provoke controversy by calling it a virtue), namely, their adventurous disposition, coupled, as it almost necessarily must be, with a desire to assert their individuality. A well-known poem to the contrary, the Pilgrims did not go from peace and quiet in Holland to the savage and inhospitable country of Massachusetts in order to obtain "freedom to worship God". They had that freedom in Holland and there was no prospect of their losing it. They crossed the Atlantic because they were unwilling to have their descendants lose their speech and identity, because they themselves wanted a chance to grow and to develop. The same energy and resourcefulness that was displayed by these early pioneers enabled some of their descendants to make New England the first and for a long time the leading manufacturing region of the country. Others it spurred to make America, for a long time, a great maritime nation. It drove others westward until they had helped to conquer a continent. In fact, the Spirit of the Pilgrims and the Spirit of the Pioneer are one and the same.

ELECTION results were approximately what nearly all of us expected, only more so. While no one but a violent partisan on one side or the other could interpret the returns as a definite endorsement or rejection of the League of Nations, there can be no question that a large majority of voters were dissatisfied with the present Administration and wanted a change. This being the case, it is fortunate that the victory was so complete, that the majority in both Houses of Congress will be overwhelming. There will be no chance for the members of any small faction to hold up the dominant party, and incidentally the country, with the threat that, unless their particular desires are met, they will desert to the Democrats. Two years from now, if the Republicans have failed to deliver the goods, there will be no chance to play the baby act. Of course, a large part of the public expects the Party to do many things that are not humanly possible for any party to do. Take the cost of living, for example. The nominal cost of living is decreasing daily, and probably will continue to do so for some time to come, whatever action is taken by the party in power. The actual cost of living, taking the people as a whole, is not going to fall very much, if at all, since incomes must fall with prices. However, the public has a right to expect, first, that as much economy as is possible in Governmental activities be practised in every department, and, second, that the tremendous amount of money, which will even then be necessary to carry on the Government, be raised by some system of taxation that will penalize extravagance and waste, not economy and thrift. If the new Administration can accomplish these ends, it will deserve, and have, the support of Business in general, including the metal trades.

ONE of the most popular of our indoor sports this winter is cabinet-making for Senator Harding. It loses none of its fascination from the fact that few of these amateur cabinets are alike. However, most of them have this point of resemblance; they include Mr. Herbert C. Hoover somewhere in the line-up. Sometimes he is named as head of the Department of State, sometimes of the Department of the Interior (which will, if pending legislation is enacted, be reorganized as the Department of Public Works); occasionally as Secretary of Labor. Without denying that Mr. Hoover could fill effectively either of the first two positions, we believe that his best usefulness to the country would be in the Department of Labor. Rightly or wrongly, there is widespread dissatisfaction with the way this Department has been, and is being, administered. Since the Secretary of Labor must necessarily do a great many things that will be unacceptable to one side or the other it is particularly important that such a man as Mr. Hoover, who possesses the confidence of all concerned in his ability and integrity, be appointed to the position.

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More Power to Them

The decision by the Executive Council of the American Federation of Labor to redouble their efforts in the fight against the radicals that are trying to 'bore from within', will meet with approval from good citizens everywhere. Whatever may be the opinion as to individual acts or policies of the Federation, there is, outside of a few reactionary circles, general recognition of its services to the nation and of the possibilities of these becoming even greater. However, as was pointed out at the Washington meeting, elimination of the Bolshevik element is easier desired than accomplished. The general organization of American labor unions is so democratic, and the control of local unions by the central bodies is so loose, that elimination of the radical from membership is impossible, and any attempt to do this would simply make the Executive Council of the Federation a laughing-stock. Nevertheless, as has so frequently been demonstrated locally, the conservative members are in the majority in nearly every union, and when properly aroused, will take control of affairs away from the radicals. It is by arousing these conservative members that we presume that the Federation officials expect to accomplish their purpose. Another praiseworthy decision reached at the Washington meeting was for closer co-operation between organized labor and industrial engineers "for the purpose of eliminating waste and inefficiency and creating an atmosphere that will foster greater production".

What Are Your Costs?

In another column appears a review of the activities and purposes of the recently-formed Industrial Cost Association. Volumes have been written regarding the importance of a knowledge of costs of production, whether of manufacture or of distribution. We have no desire to add to the discussion, but merely to point out some of the specific advantages to be gained at the present time by the American manufacturer and particularly the metal-trade manufacturer on the Pacific Coast through the organization of this Association and through membership in it. When prices are rising, and the public is willing to pay almost anything in order to get the goods, a man may be virtually ignorant of his costs, and still 'get by'. Many men have actually done this during the past few years. But a concern attempting that sort of thing nowadays might as well look up the address of a lawyer with experience in bankruptcy cases right away. He will be needed very soon anyway. However, the danger of cutting prices, in an effort to stimulate sales, below the point of profitable production is not the only consideration. This is a time when all manufacturing processes must be scanned in an effort to determine whether or not they are being carried on efficiently. How can that be done without a real cost system? Again, we are hearing, and will continue to hear, from representatives of every industry, the statement that prices in that particular industry are as low as labor and material costs will permit. Most of these statements are correct, but the public is inclined to be from Missouri. The Industrial Cost Association can help to 'show' them. Then there is the protection that the Association will help to give to the responsible manufacturer from the irresponsible idiot that names prices regardless of costs, and makes a lot of trouble for all concerned before the sheriff comes to the rescue. In fact the manufacturers of the Pacific Coast should lose no time in joining the Association. In the larger centres local chapters should be formed. In the San Francisco Bay district in particular, the metal trades men, as representing the leading industry, might well take the lead.

One Year of the Open Shop

As noted in another column, one of the most progressive among the Bay District shipyards has recently mailed to each of its employees, an attractively printed card calling attention to the fact that a year has passed since the yard re-opened, a year of uninterrupted employment at good wages under good working conditions. At this writing we do not know whether or not this example has been followed at any of the other metal-trades plants, but in any case, the facts already mentioned are worthy of the consideration of every open-shop employer and employee in the District. We wish that we could confine ourselves to the bright side of the picture as already outlined. But if that side is to remain bright and become brighter, some attention must be paid to the dark side. It is true that, except for minor sputterings, industrial peace prevails in the metal trades of the Bay district, and that much labor agitation is not probable while business and unemployment conditions remain as they are. But there will come a time once more when jobs will be looking for men, not men looking for jobs. Are the metal industries going to be ready for that time? With a few notable exceptions, how many concerns have made any bona fide efforts to establish a works council or shop committee system? How many nominally open shops are there that are in reality closed union? How many nominally open shops are in reality non-union? In short, have the metal-trades employers of the District as a whole taken adequate steps to lay a lasting foundation for industrial peace?

The Business Outlook

By Charles T. Hutchinson

Deflation, nearly two years overdue, is under way. The artificial abnormal boom that affected every branch of industry on account of the War is subsiding fast, and now "normalcy" is upon us. Industry is experiencing the pangs incident to a gorged stomach full of rich food, and the purging process is painful but necessary, while

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the chances for a better and bigger constructive development of Nature's resources are brighter than ever.

War's demands threw all of the considerations under which business is ordinarily conducted into the discard. Price or cost was relegated into a secondary place. Delivery became the prime consideration. Time was the essence, and as everything had to be produced at abnormal speed in spite of the reduced productive capacity consequent to the withdrawal of millions of labor-units for military service, an artificial shortage of labor ensued that brought the cost up to an unheard of figure.

The result was the 'silk shirt' period. The three-dollar-a-day man, finding himself in the possession of ten dollars, fifteen dollars, and even twenty dollars for one day's time, rather than one day's labor, went on a joy-ride. So did his boss. They bought lavishly of totally unaccustomed things. The vendor of fancy clothing, the purveyor of pleasure cars, the real-estate man, and the rest of the crowd experienced a boom the like of which they will probably never experience again. Our Uncle Sam himself took part in the fray, and devised a fearful and wonderful system of taxation designed to skim most of the cream off the War profits, in order that the inevitable headache of the morning after might be assuaged by some money in the treasury with which to pay the bill.

Now that the fog of battle is clearing, stock-taking is under way. Prices, securities, and all sorts of commodities are passing slowly and tortuously through the clothes-wringer of readjustment, and the water is slowly trickling out. It hurts. There is no doubt about that, but, as the conscientious mother said to her fractious child when administering corporal punishment with vigor and the aid of a slipper, "Johnny, this is altogether for your own good."

It is not surprising that the labor unions are restive at the realization that the old easy-going slackness in factory discipline is about over. Bad habits are easy to acquire, but difficult to overcome. The artificial limitation of output, which has been encouraged by many labor leaders, and was tolerated during the War period by employers because they could not help themselves, must go. The temporary hiatus in general business is the factory managers opportunity, and he is taking a deep breath and sailing into his house-cleaning with a gust of enthusiasm that is good to see.

In the factories of the country, the era of hiring and firing has returned. Unfilled orders in every field are diminishing, and, as a result, men are being weighed in the balance of performance. The loafer, the slacker, the unskilled, are being weeded out with vigor, and the effect upon the real mechanic and trained man is salutary. Many thousands of unskilled workers from the so-called non-essential industries, who, attracted by the high wages and slack discipline maintained in the shipyards and other branches of the metal trades, found their way to a place on the payrolls as mechanics, are out of a job. As a consequence, the ranks of the waiters in hotels and restaurants are again becoming preponderatingly male. Elevator-boys and bell-hops are again masculine, while real machinists are once more operating the tools in the workshops.

Throughout the country, the chief topic of conversation is the condition of the automobile industry, and its allied trades. Here is where the blow has hit hardest, with the possible exception of textiles, and here, may it be remarked, was where inflation was greatest. Attracted by the lure of enormous profits, automobiles and tires have been badly overdone. Sassy Sixes and Snappy Eights, even Nobby Fours sprang into existence overnight. Anybody who could dig up a few thousands and lease a little factory space, could assemble some sort of car, and, aided by bright attractive paint, launch it upon the market and, apparently, get by. It was the same with tires. Akron, the home of the rubber factories, became a great hive of industry. Hardly a week went by that did not herald one or two new brands of cars and tires.

Even the great established concerns responded to the psychological effect of the boom. It was in the air. They took their profits, or what was left of them after the tax-gatherers got through, borrowed more money, built more factory capacity without stint, and so on, *ad lib*, until the bubble was pricked. Now they are facing a ruthless pruning process with the prospect of operating for some time at fifty, or even forty, per cent capacity, to which must be added the necessity of marketing a large overstock of high-cost perishable goods under conditions of a forced sale.

The automobile 'game' was one of the big factors in the wrecking of the labor market for other branches of industry. The Lake Superior copper district was almost depopulated by the insistent demand on the part of the Detroit factories for any old kind of men at fancy prices. The 1920 census, taken during a period that might be called the apex of the boom, shows clearly the migration from the rural districts to the congested manufacturing districts. Now the factories are disgorging the undigested mass of 'outside' labor, which is going back to the farm or the mine, as the case may be.

Building is beginning, timidly in some places, but nevertheless it is well started, and will gather impetus from day to day until it may even generate into a race to see who will be ready first. The wave is well under way in New York city, more so there than anywhere else in the United States, and is working its way westward slowly but surely. Here, then, is the substitute for the outlet of metal products formerly consumed in such large volume by the automobile industry.

Even building construction, as well as nearly everything else, is being retarded as much as possible, by the hope of investors and buyers for lower prices. The National Association of Purchasing Agents, at their annual convention only a few weeks ago, passed a resolution to notify all of their members that in their judgment, all requisitions should be withheld from action until the last minute, in order to take advantage of the general downward tendency of all markets.

After years of chaos, the legislative and executive branches of Government will soon be in accord. Con-

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structive legislation will follow as a matter of course. We may at least hope for a reasonable economy in the administration of Government affairs, and the disbandment of the numerous War Bureaus with their hordes of clerks and petty officials.

The iniquitous excess-profits tax, with its destructive effect upon initiative and enterprise, will certainly go, and in its stead will be substituted some form of general sales-tax that will enable the Government to meet its obligations without destroying the source from which taxes flow. And then, Mr. Burleson will no longer be Postmaster-General. But enough of this panegyric.

"Normalcy" is in sight. The world is at last getting down to business. Goods must be manufactured and then sold. The old machinery for selling is being brought out of cold storage, brushed up, cleaned, and manicured ready for the fray. Expense accounts are again subject to scrutiny, and the dollar is not being thrown to the birds as a thing of no consequence. Caution, study, and careful examination is once more being devoted to betterments. The leaders of industry have not been idle during the last year, and much quiet unostentatious preparation has been under way toward the perfecting of sales organizations, methods of distribution, and the other machinery for selling, in order that the commercial machine might be ready and able to function when the time came. Underlying the surface, down-in-the-dumps condition of the stock and security market is the real, solid, sub-stratum of common sense that discerns in present conditions a necessary and beneficial purging of the whole business structure, whereby the artificial unhealthy extravagance of war profiteering has been brought to a head, lanced, and finally cured.

During a trip through Eastern and Middle-Western centres, I did not succeed in isolating one single pessimist. Even those hardest hit, the automobile crowd, for instance, regarded the drastic remedy now being applied as a good thing in the long run, and the real leaders of that industry are satisfied with the survival-of-the-fittest test that is now being applied with ruthless vigor. Money is tight, not scarce, and hard to get even at 8% for preferred short-time commercial loans. The cold blue eye and icy stare of the banker is the portion of those who ask for help for any doubtful enterprise. The custodians of the people's money are sitting tight, waiting to see the inexorable sorting process weed out the lame, the halt, and the blind, and even the best of the industrial leaders are paying fancy prices for money.

What a chance for the investor! The late J. Pierpont Morgan once said that any man who was a bear on the United States would go broke. Investment bankers are issuing charts showing the market tendency of municipal, railroad, and industrial securities and their relative return for the last five or six years. Seven and even eight per cent for first-class securities is the rule at present prices. With most of us, the situation is one to make us lick our chops hungrily, and think of the story of the man, who, when riding by a great factory remarked, "I could have bought that site for $5000 ten years ago, and now it is worth a million". His hearer asked, "Did you have the five thousand at the time?" The man did not reply.

In the meantime, watch Mexico. Since Don Porfirio, aged and worn, had the reigns of government wrested from his shaking hands, prospects for development of the resources of our oft-times troublesome neighbor on the South have never been brighter. In fact, the makings of a boom are not lacking. President-elect Obregon is known to be a strong man, a constructive thinker, and is anything but the Gringo-phobe that either Carranza or Villa were. Already many of the mines, idle for years, are making preparations for re-commencing operations, while much quiet unostentatious exploration work is under way looking toward the development of new properties. A number of enterprising manufacturers of mining machinery already have their scouts on the ground examining the field and making reports to their principals.

Unless the outgoing administration shall take action before, recognition of the Obregon regime and the restoration of diplomatic and consular relations will be one of the first acts of the Harding administration. A return of business confidence will quickly follow, and then the rush will be on. Europe will follow suit, unless it accords recognition to Obregon before we do, and there will be a merry scrap for Mexico's trade. Fortunately, the United States leads the world in the manufacture of mining machinery and appliances, and it will be years, if ever, before Europe will be able to compete from the standpoint of either efficiency, delivery, or design. Let us hope that our own people will cinch their advantage and maintain it for all time to come. Before the War, Germany was our chief competitor in that field; she flooded the market with cheap machinery that was attractive in price only, and spoiled many a legitimate sale through her price-cutting policy. Many of our readers can remember vividly the time when hammered-steel battery-shoes and dies were sold for as little as 2½c. per pound delivered at west-coast Mexican ports by the Krupp works, and other staple articles such as stamp-mills, centrifugal pumps, and steel tanks for cyanide-plants in the same proportion. There should be no return to this condition, and probably there never will be if our own people get themselves properly organized to obtain and hold the business.

Nineteen-twenty-one will be a most interesting year. The whole industrial fabric of the Nation will throw off its wartime shackles and go to work, with the intelligent help, let us hope, of the Washington government. The conservation policy that lets our natural resources go to waste will be packed away in moth-balls together with its proponents, and we will see electrical development under way on an unprecedented scale. Hydro-electric power in the United States is still in its infancy, and its future development will go a long way toward solving the coal and fuel-oil problem. With the removal of the excess-profits tax, and of the consequent stifling of individual enterprise, and at least the substantial modification of the postal-zone system for second-class mail matter, all of those who are helping to build and construct will take fresh heart and tackle the work with renewed vigor.

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Fixtures for Quantity Production of Truck Parts—I

Recognizing the importance of well-designed fixtures in securing economical production, the Fageol Motors Co. recently commissioned Clevenger & Dietrich, production engineers, of Oakland, to study their production problems. The result of this study has been the design and construction of a series of fixtures for the company's truck parts, which is one of the most complete that has ever been prepared by a Pacific Coast manufacturer. A number of the more interesting of these fixtures are illustrated and described in these articles.

Fig. 1 shows the set required for machining the rear-spring bracket. In the lower right-hand corner is the fixture for the first operation, namely milling the angle faces. Above, in the centre, is that for milling the spring-seats. Both these operations are to be performed on a No. 5 Cincinnati milling machine. The third operation is drilling three holes in the vertical flange, which is done on the drill-jig shown in the lower left-hand corner. The fourth, and final, operation on the piece is drilling fourteen holes in the horizontal flange, and counter-boring, which is done on the jig in the middle of the lower row. These operations are to be performed with a multiple drill. A rough casting is shown in the upper right, and a finished one in the upper left corner, one being a right-hand and the other a left-hand part. In the milling operations above described, as well as for those hereinafter described in this and succeeding articles, duplicate fixtures have been constructed in order to facilitate rapidity of production, one fixture being re-loaded while a casting is being machined in the other.

In Fig. 2 are shown the fixtures for the radius-rod bracket, a rough and a finished casting being also shown in the middle of the lower row. The first operation, straddle-milling the hub, is done on the fixture in the upper left-hand corner. Milling the angle-faces, the second operation, is done on the fixture in the upper right-hand corner. Both these operations are to be done on a No. 5 Cincinnati milling machine. The third operation, which consists of drilling four holes in the horizontal flange, is done on the drill-jig at the lower left. The fourth operation, drilling three holes in the vertical flange is done on the drill-jig at the lower right, which is also used for the fifth operation, drilling and reaming the hub.

In Fig. 3 we have the set for the radius-rod, the rod itself being shown in the foreground. The first operation, straddle-milling the fork-ends is performed with the fixtures at the upper left-hand corner. Both these operations are done on a No. 5 Cincinnati milling machine. For the next three operations, which are, in order, drilling and reaming the $1\frac{1}{2}$-in. holes, drilling the clamp bolt-holes, and spot-facing the clamp bolt-holes, the large fixture below is employed, the tool used being a radial drill. In the upper right-hand corner are the fixtures for the sixth operation, sawing the clamp-slots, which is done on a milling machine.

In Fig. 4 in the middle of the upper row is shown both a rough and a finished casting of a steering-gear bracket. In the lower left-hand corner is the fixture for the first operation, milling the pad. Just above it is the drill-jig for drilling and reaming as well as countersinking and facing the $2\frac{1}{2}$-in. hole that runs through the part, all of which constitutes the second operation. In the lower right-hand corner is the drill-jig for drilling four pad

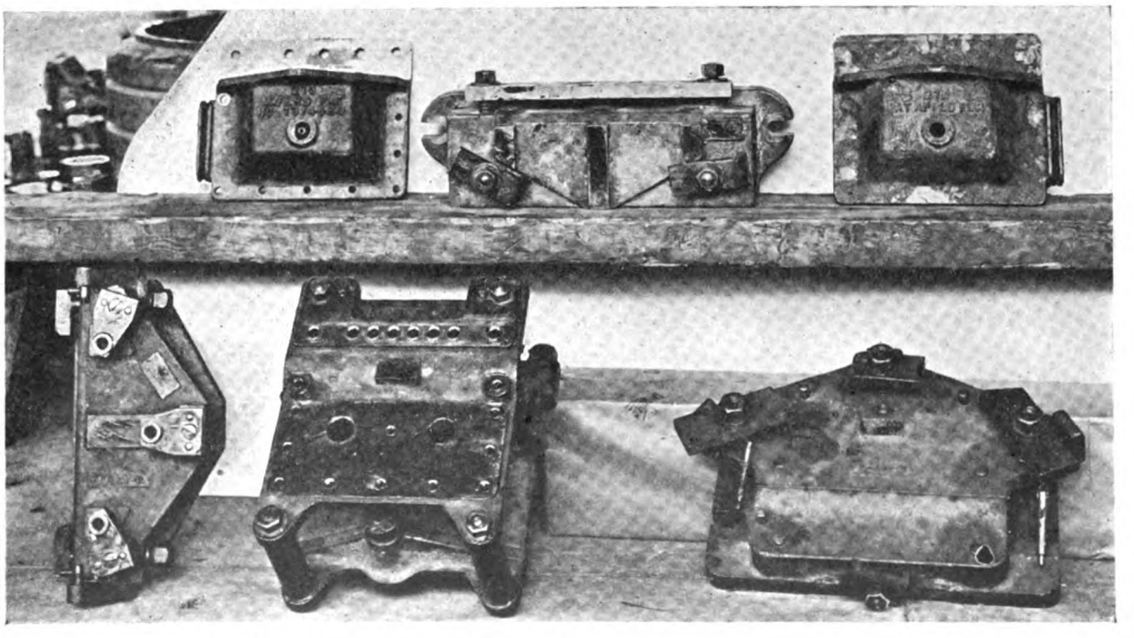

FIG. 1. REAR-SPRING BRACKET AND REQUIRED FIXTURES

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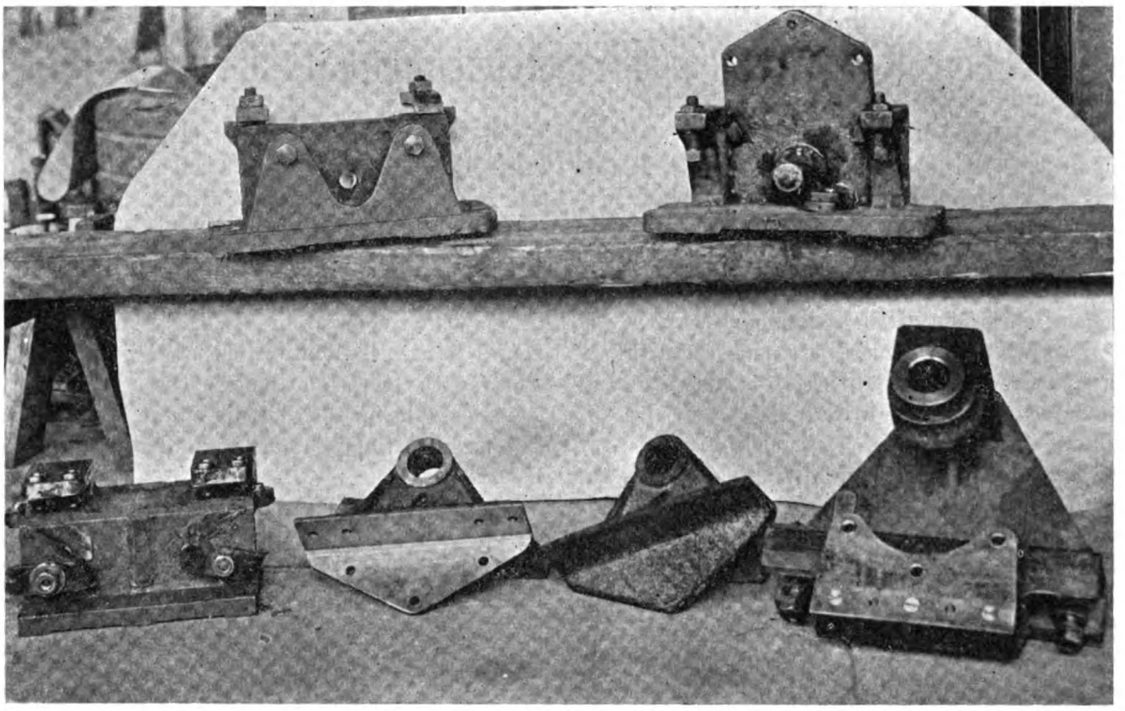

FIG. 2. RADIUS-ROD BRACKET AND FIXTURES

and two clamp-holes, which is the third operation. Above it is the fixture for sawing the clamp-slots, the fifth and final operation.

In the middle of the lower row in Fig. 5 are shown the finished castings for the rear-spring bracket-cap and for the front-spring bracket-cap. The fixture shown in the lower left-hand corner is used for disc-grinding the face of the small casting, and the drill-jig above it for drilling two of these castings in one operation on a multiple-drill. A similar fixture and drill-jig are shown at the right, and are used for disc-grinding and drilling the larger casting, the drill-jig for this part being of a different design and holding only one casting, either right or left hand.

Fig. 6 shows two sets of fixtures and the corresponding

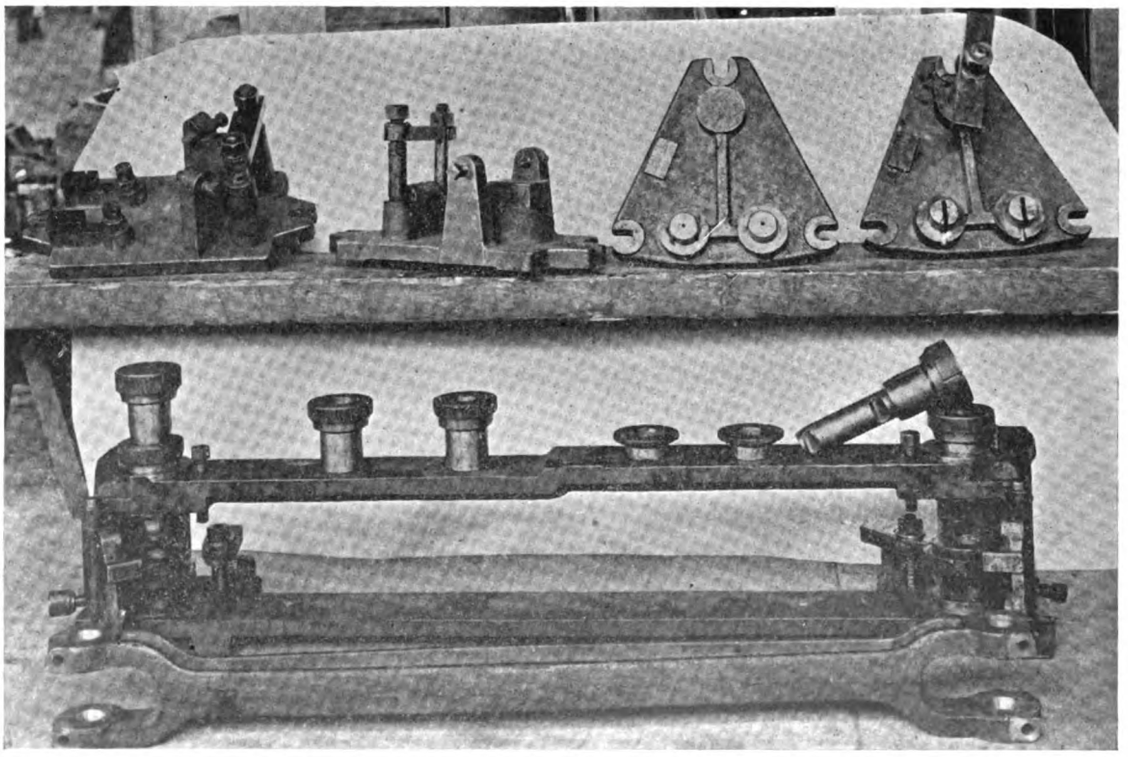

FIG. 3. RADIUS-ROD AND FIXTURES

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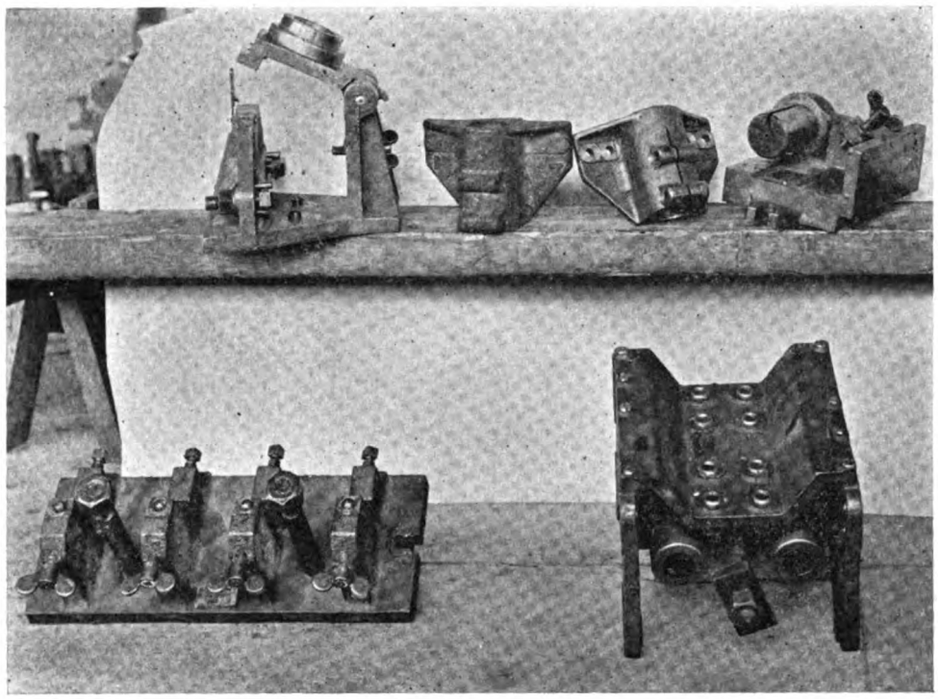

FIG. 4. STEERING-GEAR BRACKET AND FIXTURES

castings. In the middle of the upper row is the front motor-support bracket. At the extreme right is the fixture for disc-grinding the base, the first operation. The second operation, boring the large hole, is done with the fixture next to it. At the extreme left is the jig for drilling all the holes required, which is the third operation and is done on a high-speed drill. The fourth and final operation, sawing, spot-facing, and tapping the holes, is done with the fixture on the left of the casting.

In the centre of the lower row in Fig. 6 is the brake rock-shaft bracket. The first operation, drilling the two large holes, is done with the jig on the right, two pieces being machined at the same time. This is done on a multi-spindle drill. The other operation, drilling and tapping the $\frac{7}{16}$-in. hole that is seen in the top of the piece, is done with the fixture on the left.

The upper row in Fig. 7 illustrates the work on the steering-column bracket. A rough casting is shown in

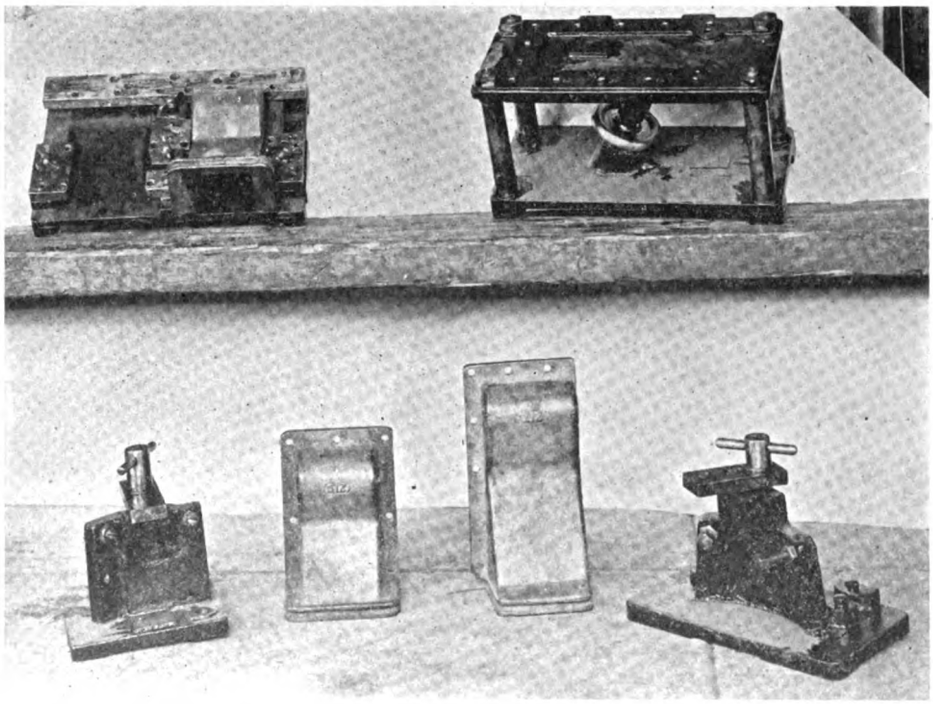

FIG. 5. FRONT-SPRING AND REAR-SPRING BRACKET-CAPS AND THEIR FIXTURES

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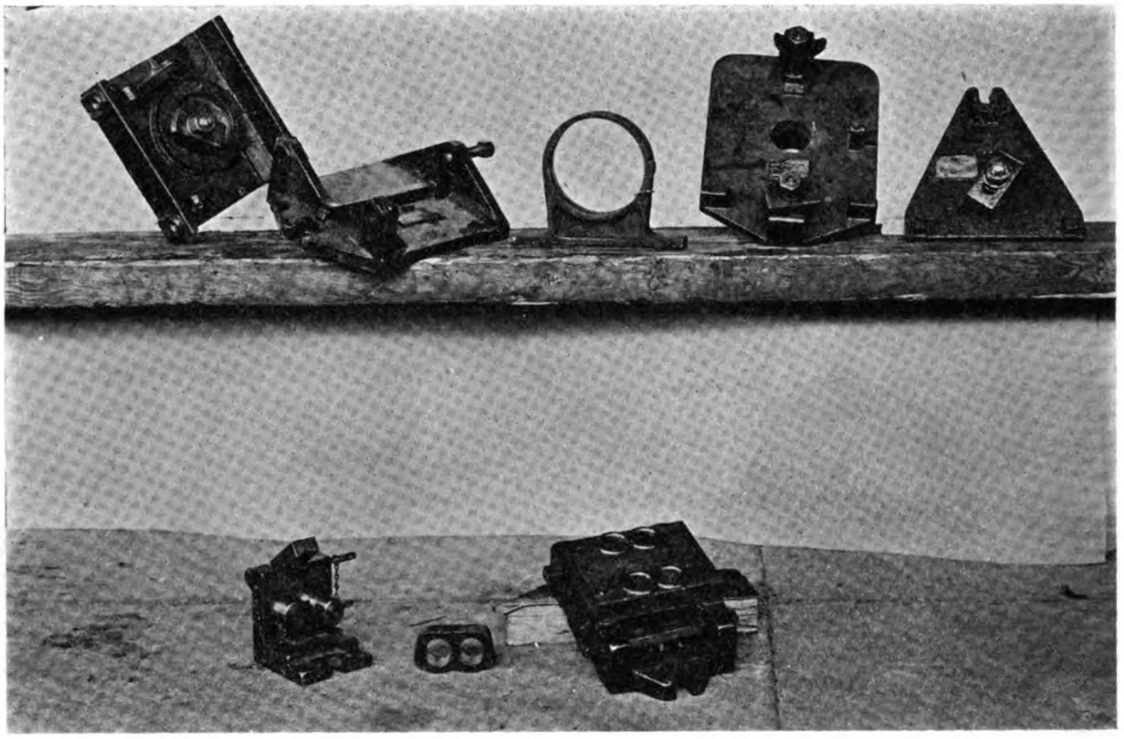

FIG. 6. FRONT MOTOR-SUPPORT BRACKET, BRAKE ROCK-SHAFT BRACKET, AND FIXTURES

the middle. The first operation, drilling the holes in the base, is done on a multiple drill, using the drill-jig on the left. The remaining work, drilling and tapping the cap-holes, is done on a high-speed drill in the fixture at the right. The small jig-plates shown at either end are for drilling the two cap-holes in the upper part of the casting.

The lower row in Fig. 7 illustrates the work on the clutch and foot-brake levers. At the extreme left is the lever used on the 3½-ton truck, while directly adjoining is the jig used for drilling and reaming the holes, using a radial drill. Beside the fixture is a set of reaming-bushings used with it. Next in order is the lever used with the 2½-ton truck, and on the extreme right is the fixture for the corresponding operations.

In Fig. 8 there are four different castings with the corresponding fixtures. At the extreme right of the upper row is a step-hanger and beside it is the jig for drilling the frame-pad holes, which is used with a multi-

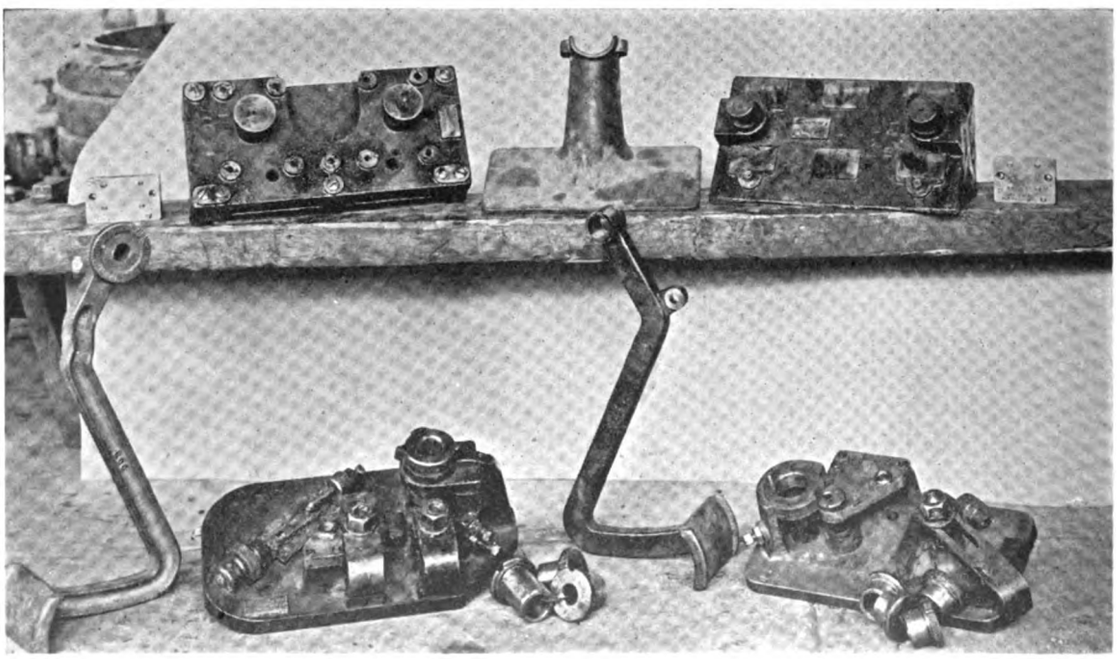

FIG. 7. STEERING-COLUMN BRACKET, CLUTCH AND FOOT-BRAKE LEVERS, AND FIXTURES

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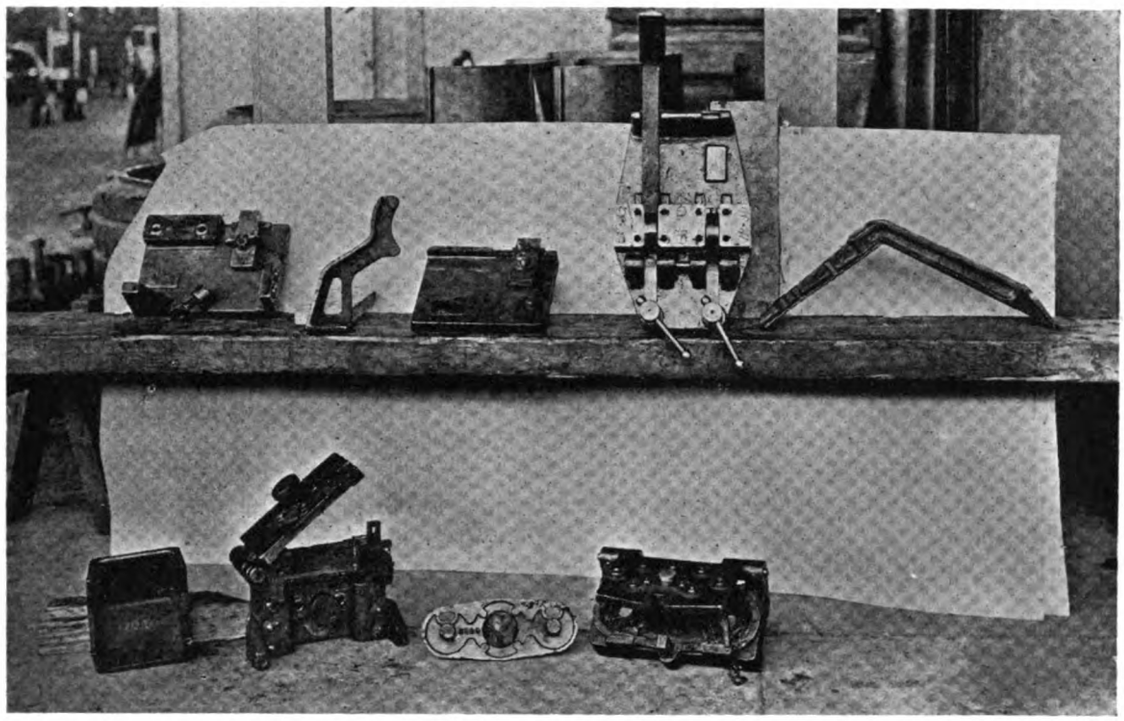


FIG. 8. VARIOUS CASTINGS AND CORRESPONDING FIXTURES

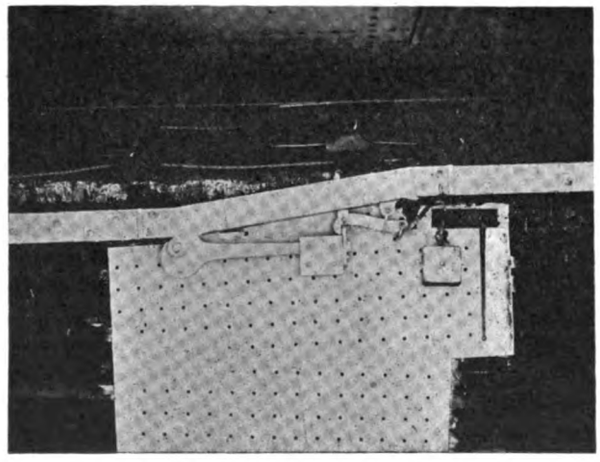
ple drill. One of the hangers is in place ready for drilling. As will be noted the fixture holds two pieces at a time. The remaining group in the upper row comprises the muffler-bracket and the two fixtures used in machining it. On the right is the one used for the first operation, disc-grinding the base on a Besly grinder, while the jig for drilling all the holes is on the left. This operation is done on a high-speed drill. In the lower row at the extreme left is a small casting with a long name, the frame rear-cross member angle-bracket. Next to it is the jig for drilling all the holes required in it, using a multiple drill. Next to this fixture is the dash-control plate, and beside it the jig for drilling all the required holes, also on a multiple drill.

(To be continued)

DESIGNING-ROOM OF CLEVENGER & DIETRICH

The Sjoberg Launching Device

The accompanying photograph shows a launching device developed and patented by J. G. Sjoberg, chief of hull construction for the Union Construction Co., of Oakland. The dark object near the right edge of the perforated blocks is a knife, which, at the proper time, is used to cut the cord supporting the weight at the left of the knife. When the cord is cut, the cam on the end of the weight-lever comes into action, and the inclined strut is forced out, permitting the ship to slide on the ways. This device has been used successfully in the launching of each of the 11 ships so far constructed at the yard, and has made it possible for each launching to be on time to the minute.



LAUNCHING DEVICE IN PLACE UNDER THE SHIP'S HULL

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The Federal Reserve System

By EDWARD ELLIOTT

Following the panic of 1907 and the discussion it provoked regarding a reform of our banking and currency system, Congress in 1908 appointed a National Monetary Commission, which undertook an exhaustive study of the banking and currency systems of all the important countries of the world. Its report, commonly called the Aldrich report, was made in 1912.

In every important European country there was a central bank, holding the reserves of the banks, serving as a discount market and having the power to issue currency. The report led to the introduction of the Aldrich bill in the Senate. This sought to give to the United States a similar central bank, but the closing months of the Taft administration were not auspicious for the passage of constructive legislation, and nothing was accomplished. President Wilson, upon his inauguration in 1913, called a special session of Congress for the purpose of revising the tariff. After months of effort, the Underwood Tariff Bill was passed late in the summer and Congress had hoped to be allowed to quit the heat of Washington and return home to rest and quiet, but the President addressed the Congress upon the need of banking and currency reform as a necessary complement to tariff revision in order that business might have the advantage of the aid that would come from needed reforms. Weary as it was from the tariff struggle, Congress took up the work of revising our banking legislation, and on December 23, 1913, the Federal Reserve Act was approved by the President.

The present Federal Reserve Act is the result of an investigation of a Commission appointed after the panic of 1907, and is designed largely to prevent or to mitigate such panics.

The purpose of the new legislation was to remedy the evils of the old system by providing a central-reserve system, a steady discount market and a currency elastic in volume. The Aldrich plan had contemplated a central bank controlled by bankers. The Federal Reserve Act provided for a maximum of 12 Regional Reserve Banks, each under its own board of directors and all under the Federal Reserve Board. This Board is composed of seven members, of whom two, the Secretary of the Treasury and the Comptroller of the Currency, are members ex-officio, and five are appointed by the President for a term of ten years. The Federal Reserve Board is the agency through which the administrative centralization of the 12 Federal Reserve banks is achieved, but the powers of the board are not limited to mere matters of administration for the centralization, or rather unification of operation of the 12 banks, is likewise in its hands since the Board may compel one Federal Reserve bank to re-discount for another.

The 12 Federal Reserve banks have been likened to twelve reservoirs of credit; each member bank has its own pipe-line running to the reservoir and the twelve reservoirs are connected by pipe-lines to a central station, the Federal Reserve Board, which can direct the flow from one bank to another and thus adjust the credit-level in all—or, putting it in other terms, the Board can adjust the reserves of the different banks and maintain an average reserve percentage for the system.

Each Federal Reserve bank is governed by a board of nine directors, six of whom are elected by the member banks while three are appointed by the Federal Reserve Board. There are three classes of directors, called A, B, and C, composed of three each. Class C consists of the appointed members, one each year to serve for a term of three years. Class A are elected by the member banks; they are representative of the banks and are generally bankers. Class B are likewise elected by the member banks but are business men. The member banks are divided into three groups according to capitalization so that the capital represented in each group shall be as nearly equal as possible. This results in the few large city banks composing one group, the more numerous medium-sized banks of the larger towns composing another, and the very large number of small country banks the third. Each group elects one Class A and one Class B director once every three years.

This seemingly complicated procedure leads to the choice of three directors, one from each class, each year. The directors choose the Governor, Deputy Governor, and other officers who carry on the active banking operations. The Federal Reserve Board names one of the Class C directors as Federal Reserve Agent and Chairman of the Board. As Federal Reserve Agent he maintains a local office of the Federal Reserve Board in the Federal Reserve bank and serves as the connecting link between the Board and the bank. He also has custody of the Federal Reserve notes which he issues to the bank in return for gold or gold and re-discounted paper.

The growth of the Federal Reserve banks has been extraordinary. When the Federal Reserve Bank of San Francisco was opened for business on November 16, 1914, the entire staff, including janitor and watchman, numbered 22, and occupied a small space at the rear of the Merchants National Bank. Today it overflows a six-story building of its own and is beginning the erection of a permanent building, with more than double the present floor-space. In addition to the head office in San Francisco, there are five branches, at Spokane, Seattle, Portland, Salt Lake City, and Los Angeles, and the staff now numbers more than 1000. The territory embraced within this, the Twelfth Federal Reserve District, includes the States of Arizona (except the five south-eastern counties), California, Nevada, Utah, Idaho, Oregon, and

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Washington. It is greater in extent and more diversified in activities than any other district.

A Federal Reserve bank is often called a bank for banks. All National banks must be members, and eligible State banks may become members if they wish. A bank becomes a member by subscribing to the stock of the Federal Reserve bank of its district in an amount equal to 6% of its capital and surplus, half of which is paid in gold or gold certificates, and the other half is subject to call. Out of the net earnings of a Federal Reserve bank, its member banks are entitled to a cumulative 6% dividend upon the paid-up capital stock. The rest of the profits go into surplus until the surplus equals the subscribed capital stock; thereafter 10% of the net earnings after payment of dividends goes to surplus and the balance to the Government as a franchise-tax.

There are three fundamental principles of the Federal Reserve system: the centralization of reserves, the ability of member banks to borrow and re-discount, and the note-issue privilege. These three principles are so closely related that the absence of any one of them would render the operation of the system of comparatively little value. Let us consider them in the order named.

Every member bank now carries all its legal reserve with the Federal Reserve bank of which it is a member. The only cash in vault that a member bank need carry is the amount necessary to transact its daily business, or what may be called 'till' money; there is no legal requirement for vault cash. In view of the centralization of reserves and the re-discount facilities furnished by the Federal Reserve banks, the percentage of deposits that must be carried as reserve has been materially lessened. Before the Federal Reserve system went into operation, country National banks carried a 15% reserve against demand deposits; reserve city banks a 25% reserve, part cash and part deposits with other banks, and central-reserve city banks a 25% reserve, all cash. These percentages have been reduced to 7, 10, and 13, respectively, all with the Federal Reserve banks, thereby releasing for investment a large amount of funds previously tied up in idle reserves. The Federal Reserve banks pay no interest on the reserve carried with them. In view of the very large earnings of the Federal Reserve banks, the member banks have begun to urge that they should be paid interest on their reserve.

Centralization of reserves has released for investment a large amount of bank funds previously tied up in idle reserves.

One of the bad features of the old system was the payment of interest on reserves, for it made it necessary for the depositary bank to lend out a large part of these funds. The Federal Reserve banks ought never to be required to pay interest on the reserves. They are essentially reserve institutions and they ought to be free to keep their funds in hand to meet any emergency and not be put under the pressure of earning interest on reserve deposits. Moreover, they are not money-making institutions, paradoxical as that may sound in view of their large earnings. They should never be regarded as money-makers for their members, lest a spirit should grow up which would lead to their control for the purpose of making money for the members instead of for the purpose of meeting the unexpected or unusual financial strain and of stabilizing business and financial conditions.

So much has been said on this subject, and bankers are sometimes so insistent that a larger share of the profits should go to them, that it is worth while seeing what justice there is in their position. The average banker thinks that the profits of the Federal Reserve banks have been made with his money and therefore he should share in them, and that if there were no Federal Reserve bank he would be getting interest from some other bank. Aside from any other advantages that have accrued from the Federal Reserve system, the percentage of reserve has been lowered and the average bank makes rather than loses. The question may be put in this way: Is a high reserve percentage, with low interest on half of it, more profitable than a low percentage with current rate on the amount represented by the difference in percentage? Let us take an example from a bank in a reserve city with $40,000,000 demand deposits. Under the old system its reserve would be 25%, or $10,000,000, half cash in vault, earning nothing, and half, or $5,000,000, with other banks at 2 to 2½%. At the latter rate, the interest per annum would be $125,000. This the banker thinks he has lost through receiving no interest on his reserve with the Federal Reserve bank. How does the matter stand in reality? As a member, the Reserve city bank with $40,000,000 demand deposits carries a 10% reserve, or $4,000,000, with the Federal Reserve bank without interest. But this is $6,000,000 less than formerly. At 6% the yield would be $360,000. Assuming that the bank might need $3,000,000 of this $6,000,000 as cash on hand or 'till' money, its income from this reserve released would still be $180,000, or $55,000 more than under the old scheme. In addition, it has the benefits of the Federal Reserve system. Moreover, the profits of the Federal Reserve banks have been made only through the use of them by the members. Every time a Federal Reserve bank makes a dollar, it is due to the fact that a member bank has borrowed or re-discounted, thereby securing additional funds to lend at a rate higher than the discount rate; or the Federal Reserve bank has bought acceptances in the open market that banks would otherwise have had to carry, and, as acceptances bear a low rate, bank funds are thereby released for more profitable use.

The centralization of reserves would be of little value unless accompanied by the ability on the part of the member banks to borrow from or re-discount with the Federal Reserve banks, since in this way alone can they draw upon the credit reservoir created by pooling reserves. A member bank may borrow from its Federal Reserve bank for a period not to exceed 15 days on its own note, secured either by U. S. government bonds and certificates of indebtedness or by paper eligible for re-discount or purchase. Banks or-

By borrowing from or by re-discounting with Federal Reserve banks, members of the Federal Reserve system are able to draw upon the credit reservoir created by pooling reserves.

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dinarily do not borrow money, although there may come times in the life of every bank when it is both necessary and proper to borrow, but it is supposed that the occasions will be rare and due to some temporary condition, hence the limit of 15 days put upon the time.

In respect to discount operations, the Federal Reserve Act provides that notes, drafts, and bills of exchange made for an industrial, commercial, or agricultural purpose or the proceeds of which have been or are to be so used, are eligible for re-discount under regulations to be provided by the Federal Reserve Board. Industrial or commercial paper must have not more than 90 days to run, and agricultural—which includes livestock paper—not more than six months when presented for discount.

There are strict limitations on the character of the notes or other securities presented for re-discount to a Federal Reserve bank.

No loan that has been made for investment purposes or for the purpose of carrying or trading in stocks or bonds is eligible. In addition to being eligible, paper presented for re-discount must also be acceptable. There must be a reasonable expectation that the paper will be paid at maturity, and to satisfy itself on this score the Federal Reserve banks may require every note presented for re-discount, unless secured by warehouse receipt, bill of lading, etc., to be accompanied by a financial statement of the maker, which must show an excess of quick assets over current liabilities sufficient to warrant the expectation of payment at maturity.

Let us see how the matter works out in practice. We will suppose my credit at my bank is good for $5000 and I borrow this amount on my unsecured note to buy stock or to build a house. If my bank wished to re-discount this note with the Federal Reserve bank, it would ask me to make out a financial statement, if it did not already possess one, and the note, together with a copy of my statement, would be sent to the Federal Reserve bank. There, upon examination of my statement, it would be seen that I was not engaged in business and was not a farmer and that the note had not been made for any one of the purposes allowed by law, and it would not be accepted. If, however, I were a manufacturer buying material with the proceeds, or a merchant buying goods, or a farmer buying hay or fertilizer or cattle, or harvesting my crop, the note would be re-discounted if my statement proved satisfactory.

In the face of the enormous re-discounts of today, it is hard to believe that six years ago, when the system was put into operation, banks were very unwilling to show re-discounts on their statements. The problem, then, was to get the banks to use the system; now, it is to find a way to limit them in the amount they may re-discount.

The Federal Reserve Act provides that there shall be no discrimination among member banks but that in accommodating one bank due regard shall be had to the interest of all other banks. When the credit expansion began to cause alarm last spring, Congress amended the Act, granting to the Federal Reserve banks the right to put into effect a progressive discount rate in accordance with which a basic line of credit for a particular bank would be determined and any accommodation beyond this would be subject to a higher discount rate, which is subject to a progressive increase as the amount borrowed increases. Four of the Federal Reserve banks have applied the progressive rate, but its influence in checking expansion is problematical.

The Federal Reserve Bank of San Francisco has not adopted the progressive rate, but has required additional collateral, which serves to reduce the paper of the member bank eligible for re-discount with the Federal Reserve Bank and also to limit its borrowing capacity with other banks. The discount rates are determined by the boards of directors of the Federal Reserve banks, subject to the approval of the Federal Reserve Board.

The third fundamental principle is that of note-issue. Federal Reserve banks may issue Federal Reserve banknotes and Federal Reserve notes. The former is a currency similar to National Bank notes in that it is based on bonds and has been used chiefly to supply bills of small denominations. The latter constitute a currency intended to expand and contract in volume as the volume of business expands and contracts—an elastic currency. Federal Reserve notes may be issued against gold, or against gold and re-discounted paper. They are in the custody of the Federal Reserve agent and are issued by him to the bank. Under normal circumstances there must be at least 40% of gold back of every Federal Reserve note issued, the rest being re-discounted paper; but this limit of 40% may be lowered by the Federal Reserve Board.

Those who have followed the reports of condition of the Federal Reserve banks will have seen that the average reserve of the system has been for months in the low forties and there has been much discussion of what would happen should it fall below that amount. As a matter of fact, the reserve of individual Federal Reserve banks has fallen far below 40%, but by the ability of Federal Reserve banks to re-discount for each other, banks having higher reserves come to the help of the banks faced with demands beyond their means, and in this manner the average reserve of the system has been maintained above 40%. But nothing would happen if the reserves of the system should fall below 40%, that is, nothing in the nature of bankruptcy of the system. The Federal Reserve Board would simply lower the required reserve percentage. There is nothing sacred about the 40%, and it is possible that much of the discussion about the dangerously low point reached has been welcomed by the Board as a valuable adjunct to its general compaign to impress upon the bankers and the public the extent of credit expansion and the need for curtailment.

The credit-lending power of the Federal Reserve banks lies in their power to issue Federal Reserve notes. A dollar in gold in the vault of a bank is worth a dollar and no more. By no possible means can the bank make it worth more, but in the vault of the Federal Reserve banks it is worth two dollars and a half in credit, or

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Federal Reserve notes, if there is re-discounted paper in the hands of the bank.

Let us look at the transaction from another angle. John Smith is engaged in business and needs money to buy goods. He goes to his bank for a loan; his credit and his business are good, but his bank has reached the limit of its available funds, but if Smith's note is eligible for re-discount with the Federal Reserve bank, his bank, if a member, can make the loan, for it can immediately re-discount with the Federal Reserve bank and again be in funds. It gets from the Federal Reserve bank, Federal Reserve notes. John Smith's note may in this fashion be converted into currency up to 60% of its amount. John Smith's note would not circulate as currency but the Federal Reserve note will.

Re-discounting by a Federal Reserve bank permits the extension of credit to a man that deserves it even when his local bank has reached the limit of its available funds.

The ability of the Federal Reserve note currency to expand has been completely demonstrated, since there are now outstanding some $3,000,000,000 of such currency. It has yet to be determined whether it has the ability to contract with equal facility as the volume of business contracts.

During the post-war period of readjustment, the Federal Reserve system has had many serious problems to face, but none more serious than that touching its policy toward inflation and high prices. With respect to the latter, the position has been consistently maintained that it was not the function of the system to attempt to regulate prices. Its duty pertained solely to dealing with the credit situation and if in its action in relation to credit, prices were affected, this must be regarded as incidental merely.

In dealing with inflation, the Federal Reserve Board has confined itself to regulating credit. Any effect upon prices must be regarded as merely incidental.

As long as a year ago the expansion of bank credit was a cause of concern to the Federal Reserve banks and to the Board, and in November 1919 the discount rates were raised. It was supposed that following the crop-moving season, liquidation would set in, credit would be contracted, and the reserves would be increased; but instead of liquidation, there was continued expansion, with the result that in January rates were again raised. The normal effect of a raise of rates is to discourage re-discounts and to cause the banks to restrict their loans, but the conditions of the early part of 1920 were not normal. There was a spirit of extravagance and of speculation; production had fallen off and distribution was seriously curtailed by deficient transportation; goods and farm products were stored in warehouses and terminals and could not be moved; they were being financed in large part on credit and until they could be moved to the point of distribution and consumption, these credits were 'frozen'. Moreover, it was a seller's market; the public was insistent upon buying and price seemed a small consideration. In these circumstances a raise in the discount rate could not have its normal effect. But the action of the Federal Reserve banks in raising rates and the warnings of the Federal Reserve Board that the credit situation was becoming acute, focussed the attention of the country upon the need of conserving credit. Through the Federal Reserve banks and the member banks the borrowing public was impressed with the necessity of curtailing its loans and of limiting credit to the essential industries. In a remarkably short time the psychology of the general public underwent a marked change. It was no longer recklessly extravagant and regardless of price. The public demanded lower prices; it became a buyer's instead of a seller's market. Merchants reduced their stocks and liquidated a part of their indebtedness. The bankers sought to eliminate all unnecessary and speculative loans, transportation improved, and some 'frozen' credit was thawed out.

The fear in the spring had been that the seasonal demands of the crop-moving season could not be met without a reduction of the reserves of the Federal Reserve banks below 40%. That danger seems past. Liquidation has, in some directions, taken place, though the total volume of loans has increased; legitimate and necessary business has been financed; inflation has been checked without panic; price readjustments have been taking place. In the process some individuals and some industries have been hurt. There has been no market for wool; financing of the cotton crop, wheat, and the livestock industry has been difficult, but the policy of the Federal Reserve Board, aimed at the checking of expansion, and at the stabilizing of conditions to prevent a sudden crash, has met with marked success and approval.

New Way to Sell Land

Maine real-estate agents have discovered a new way to dispose of undesirable property.

On one of the roads leading out of Bangor is a rocky abandoned farm, forty acres of land that no man would take as a gift. A small fortune has been expended in advertising this place for sale, but in vain.

Then along came a broker with ideas, and he sold the farm at a pretty good price. This broker admitted that the place was run down, and that the buildings were wrecks. But he casually remarked:

"The man who owns this place is in jail, serving a sentence for selling rum. He won't be out for a month or two yet. They say that just before the lid was jammed on, this fellow bought a big stock of whiskey, but the sheriff never has been able to find any of it. The stuff couldn't have been sold, for it didn't arrive in Bangor until about a week before the lid went on. I guess there is some truth in the story that he carted it out here and buried it on this farm. Anyway he made a lot of night trips out here about that time. Better have spent the price of that liquor fixing up these buildings."

The farm was sold next day.—New York World.

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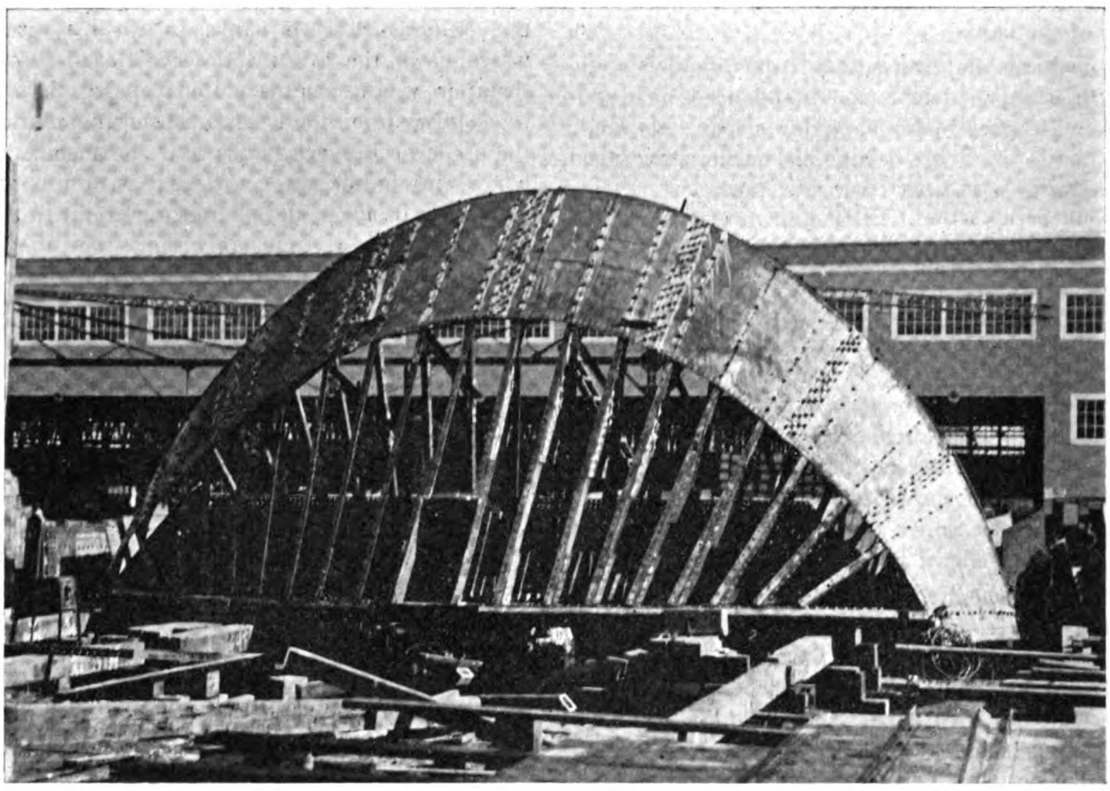

FIG. 1. 'FANTAIL' IN FABRICATING YARD

Yard-Fabrication Facilitates Ship Construction

An important factor in the general increase of speed in ship construction during the past few years has been the change from the old method of doing nearly all the riveting in place in the hull, to that of handling most of the fabricating in the yard and then placing the heavy fabricated sections in position in the hull by means of cranes. While this is being done to a considerable extent in all yards building steel ships, it is probable that the Union Construction Co., of Oakland, has made as much progress in the development of this method as any yard on the Pacific Coast.

The accompanying photographs were taken at the company's yard during the raising and placing of the 'fantail', or rearmost stern-section for the steamer 'Liebre', a 10,200-ton tanker under construction for the General Petroleum Corporation. The completed fantail as it stood in the yard was 35 ft. long, 12 ft. broad, and 12 ft. high, containing over fifty main pieces and weighing

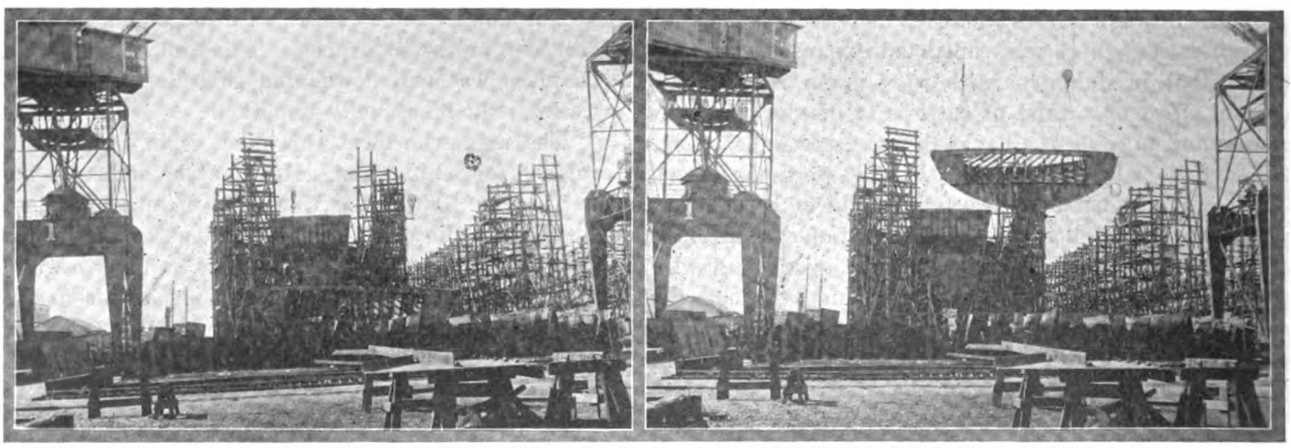

FIG. 2 AND 3. TWO VIEWS OF RAISING OF 'FANTAIL'

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about 17 tons. Fig. 1 gives an excellent idea of the size and shape of the piece ready for transportation to the ship.

The 'Liebre' is to be launched stern foremost, and the section was transported from the fabricating yard a distance of about 600 ft. to its place at the stern of the vessel. Two 'Brownhoist' cranes running on tracks paralleling the ways were used. These cranes have a nominal capacity of 7½ tons each, which, as will be seen, was slightly exceeded, but there was nevertheless a considerable margin of safety, since the cranes are tested for a 50% overload. The base of the cranes is 50 ft. above the ground-level, and the boom-radius is 80 ft., which permits handling material for any part of the hull.

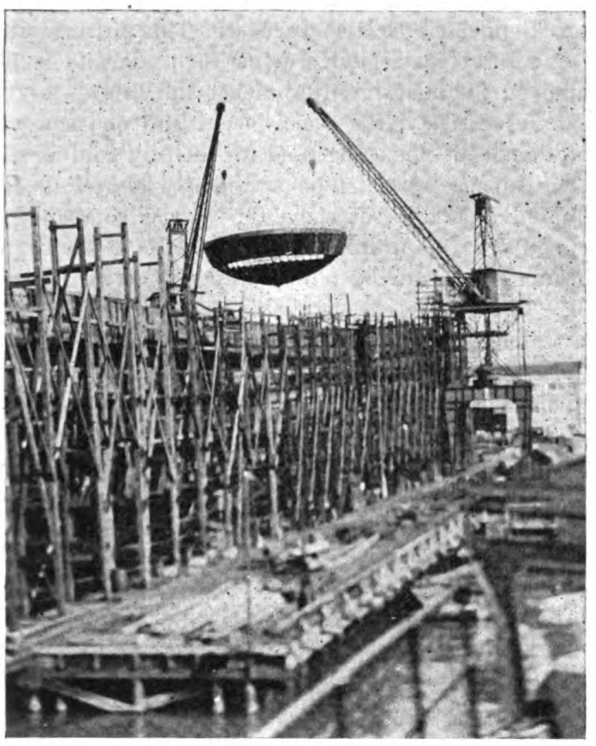

FIG. 4

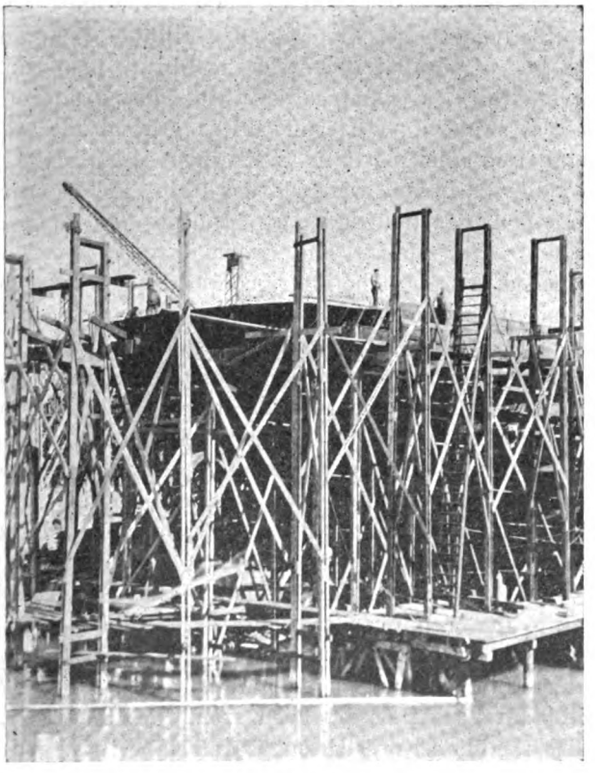

FIG. 5

FIG. 6

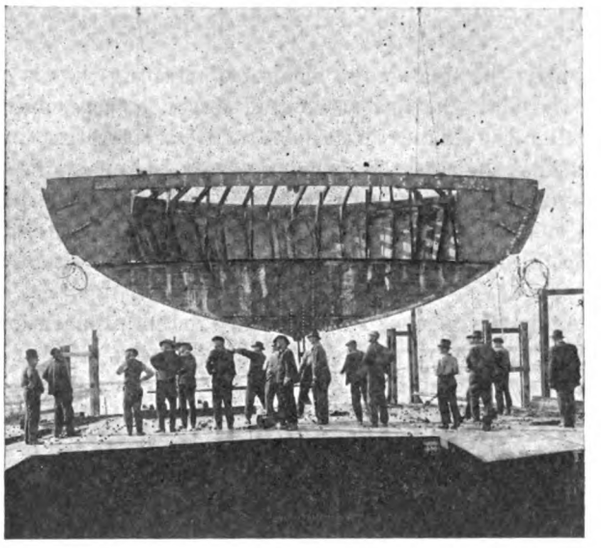

FIG. 7

Fig. 2 shows the fantail just after it had been raised and turned, and Fig. 3 shows it a little further on its journey. In Fig. 4 it has traveled about half the length of the vessel. Fig. 5 shows the stern of the ship, ready

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for the section to be put in place, while Fig. 6 shows the section being lowered into place. Fig. 7 was taken from another position during the lowering of the section, and Fig. 8 shows it in place. Only five minutes was required to fit the section in place after it had been lowered. The complete operation for similar sections usually requires about half an hour but in this particular case, the work was delayed a little by a minor mechanical difficulty with one of the cranes.

The increased speed of construction effected by doing as much of the fabricating as possible in the yard, leaving a minimum amount to be done on the hull itself, has already been mentioned, but this is only one among many advantages obtained. Perhaps one of the most important of these arises from the fact that, even with all precautions taken, the hull of a ship during construction cannot be made as safe a place as the fabricating-yard. Consequently, the smaller the amount of riveting that is done on the hull, the fewer the men working there, and the smaller the chance of accident. Better riveting is obtained in the yard than when the work is done on the hull. Saving of time, reduction of accidents, and reduction in the number of poor rivets that must be cut out and replaced, all contribute to a reduction in the cost of construction.

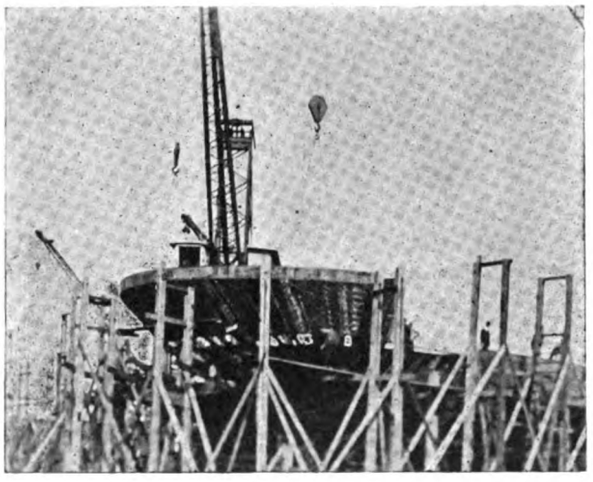

FIG. 8. 'FANTAIL' IN PLACE

Acknowledgement for assistance in the preparation of this article should be made to J. G. Sjoberg, chief of hull construction for the Union Construction Co., who is also largely responsible for the development of the method of yard fabrication at the company's plant. Acknowledgment is also due to C. L. More, for three of the photographs used to illustrate this article.

A CERTAIN CLOTHING STORE advertised for a man to handle some special lines.

"What we want," said the head of the firm, who was interviewing one of the applicants, "is a man that is acquainted with the tastes of the best people in town."

"That's me every time," was the reply. "For the past ten years I worked in the swellest saloon here."

San Francisco Mint Adopts Electric Furnace for Melting Copper and Nickel

The U. S. Mint placed in operation on November 9 a ½-ton Rennerfelt electric furnace. This furnace supersedes several gas-heated crucible-furnaces, and is being employed for melting cupro-nickel and bronze mixtures used, respectively, for the five-cent and one-cent coins. The furnace is not being used for melting gold or silver.

The furnace operates on two-phase, 60-cycle current, supplied at 2200 volts by the power company, and stepped down to approximately 110 volts at the furnace. The amperage during a heat ranges between 650 and 800. There are three carbon electrodes. The holders are water-cooled and the arc is regulated by hand. It is probable, however, that this will be superseded by automatic regulation. The furnace has an acid lining and bottom, silica brick and sand being used. It is charged with pigs of copper, nickel, etc., together with crop-ends from the ingots, punchings from the sheets of metal from which the blanks for coins are cut, and other scrap from the coinage operations. On account of the method of operation, however, this scrap is practically as free from impurities as the original metal. No flux is used, but a layer of charcoal is shaken on the surface of the metal in the pouring-ladle to protect it from oxidation. The ladle is filled by tilting the furnace on a horizontal axis, the tilting mechanism being operated by hand.

At the present time the metal is poured into a hand-ladle holding about 100 lb. of metal, and from the ladle into the ingot-molds, which are of steel and are arranged in a sort of circular rack. The molds are made in two halves, which are clamped together. The inside of the mold is swabbed with crude oil to prevent the molten metal from adhering to it. Each ingot is approximately ¾ by 3 by 24 in. and weighs about 10 lb. A few minutes after pouring, the ingots are cool enough to permit opening the molds. The ingots are removed and quenched in water, the interior of the molds is swabbed again with oil, and the molds are re-clamped ready for pouring again. After cooling, the ingots pass to the cropping machine where the upper part of the ingot is sheared off. The ingots then go to the rolling-room. This procedure is soon to be modified by the installation of a slow-moving conveyor upon which the ingot-molds will travel. Operations will be timed so that, at the proper interval, the molds will be opened, the ingots quenched, and the molds returned to the pouring-position. A conveyor will also take the ingots from the quenching-tank to the cropping machine. In the rolling-room the ingots are rolled into sheets the thickness of the coins, 22 passes through various-sized rolls being required. The coin-blanks are then punched from these sheets, after which the blanks pass through a machine that turns up the edge. They are then annealed and polished before the final operation of stamping.

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Shop Facilities and Other Mechanical Features of the Mare Island Navy Yard*

The Mare Island Navy Yard consists of a training camp, Marine barracks, Naval hospital, Naval magazine, and industrial yard proper. The total of new construction and equipment at the Yard during the War amounted to $10,148,000. The total plant investment, as of 1920, is $32,036,196.84.

The industrial part of the Yard is planned to care for capital-ship construction and repair. With the completion of the new Structural Shop group this work will be greatly facilitated. Industrial work is divided between the Machinery Division and the Hull Division.

Machinery Division

All machine-shops are assigned to the Machinery Division. These are machine-shop No. 1, which handles, in general, large work, machine-shop No. 2, which handles, in general, small work, machine-shop No. 3, which handles repetition and quantity work, and machine-shop No. 4, which handles mechanical installations on board ship.

Machine-Shop No. 1

Machine-shop No. 1 is equipped for the manufacture and repair of turbines, shafting, pumps, blowers, and safety-valves, the generation of large reduction-gears, and the balancing of rotating bodies by the Akimoff balancing method. All ordnance work is also handled by this shop. Diesel engines for submarine boats have in the past been manufactured by this shop, and at present the engines of the German submarine U-88 are disassembled there for inspection. There is a testing-room in this shop that is equipped for the testing of valves, condensers, evaporators, distillers, auxiliary machinery, pumps, and other equipment.

The principal machine-tool equipment comprises about 75 lathes of different manufacture, the largest being one recently installed of 174 in. swing by 60 ft. between centres; 6 planers of various sizes, the largest being of the open-side type 108 in. wide by 35 ft. long by 9 ft. under rail (two of these planers are also equipped for planing propellers); about 25 boring-mills, horizontal and vertical types, the most important being one of the vertical type having a 24-ft. swing by 8 ft. under rail and one of the horizontal type, being a draw-cut traveling-head planer, boring, drilling, and milling machine with 7-ft. stroke, the feeds ranging 14 ft. horizontally and 10 ft. vertically; 20 emery grinders and grindstones, the principal one being a Landis grinder 20-in. swing with 12-ft. bed; 18 milling machines of different manufacture and sizes; 8 shapers, one being of the draw-cut type 48-in. stroke with feeds 36 by 16 in.; 5 slotters, the principal one being a portable type with 96-in. stroke; and 2 Gould & Eberhart and 2 Parsons gear-hobbing machines. There is also equipment for the calibration of shafts used with the Gary-Cummings torsion-meters. There are also many minor tools such as metal-saws and hydraulic presses.

Machine-Shop No. 2

Machine-shop No. 2 is usually engaged in the manufacture and repair of steam-launch engines, gas-engines, deck-winches, steering-engines, and hull-fittings and valves. Nearly all of the plant repairs, such as those for locomotives, cranes, and steam-shovels, are assigned to this shop, as well as the drop-forge and sheet-metal die-work. The principal machine tool equipment consists of about 100 lathes of various sizes and makes, 37 drills, including heavy-duty presses and sensitive drills, 24 milling machines of different styles and manufacture, 12 shapers, 6 planers, 8 boring-mills of vertical and horizontal types, 3 slotters, and minor tool equipment including such items as bolt-cutters, emery grinders, centring and tapping machines, pipe-cutters, broaching machines, and key-seating machines. The gear-cutting department has one 48-in. Gould & Eberhart gear-hobbing machine, one No. 4 Farwell hobbing machine, one Fellows gear-cutter, and one 36-in. Adams automatic gear-hobber.

Nearly all the turret and automatic lathes of the Navy Yard are assembled in this shop, and the other shops requiring screws, studs, or bolts in any quantity call upon this shop to fill the order. The small brass-lathes are installed in the gallery of building No. 52. This gallery is also equipped for an assembling-room for small valves and fittings. In addition to the brass-lathes there are three 20-in., one 18-in., and four 16-in. engine-lathes, two drill-presses, two shapers, one milling machine, and several sensitive drills. One end of the gallery is devoted to the repair and upkeep of air-tools. This shop also operates the central tool-grinding station.

Machine-Shop No. 3

Machine-shop No. 3 was used during the War for the manufacture of projectiles, but upon the completion of the projectile order, the special machine tools were removed, a number of other tools installed, and the entire shop rearranged with the idea of putting this shop on a manufacturing basis.

Brass and Steel Foundry

The brass-foundry and the steel-foundry are housed in the same building, the steel-foundry occupying the west end, where there has been installed recently a six-ton Greaves-Etchells electric furnace.† Additional foundry

*Based on leaflet prepared for the benefit of members of the American Society of Mechanical Engineers and others visiting the Yard on November 4, 1920.

†See 'Metal Trades', April 1920, p. 161.

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equipment consists of one 2-ton Tropenas steel-converter, one 42-in. cupola, one large core-oven, three small core-ovens, three 1000-lb. Schwartz furnaces, two 1500-lb. U. S. brass-furnaces, one 4-ton reverberatory brass-furnace, and one annealing-oven.

Iron-Foundry

The iron-foundry is equipped with two 72-in. McKensie cupolas and one 32 and one 48-in. Colliau cupola. Castings up to 30 tons have been successfully manufactured. The cupolas are supplied by positive-action blowers, which will be replaced in the near future by two centrifugal blowers.

Boiler-Shop

The boiler-shop is equipped to manufacture any type and size of boiler. The boilers for the 'California' and all the destroyers built at the Yard were manufactured in this shop and those for the 'Montana' will be made here in the near future. The use of oxy-acetylene and electric cutting and welding has been developed to a point of high efficiency and is extensively used in boiler work.

Electric-Shop

The electric-shop is engaged in the overhauling of motors, generators, and storage batteries, the wiring and electrical work for the 'California', and the overhauling of electrical equipment of all kinds. Attached to the electric-shop are the gyro-compass section, optical section, electro-plating section, clock-repair section, and physical laboratory. Mare Island is the main repair and testing station on the Pacific Coast for gyro-compasses and optical equipment.

Copper-Shop

This shop is modern in all respects and has the necessary equipment to handle expeditiously all copper work connected with modern ship construction.

Pattern-Shop

While the pattern-shop is well equipped with woodworking tools, it is somewhat congested. In spite of this, a large volume of work is turned out. This shop is making all the patterns for the use of the Columbia Steel Co. for the manufacture of castings for battleships 49 to 52. The pattern for the rudder-post for the 'Montana' measures 22 by 17 by 18 ft., and is probably the largest pattern ever constructed on this coast. During the first five months of 1920, the shop used more than 60,000 ft. of lumber in the construction of patterns.

Power-Plant

The power-plant is operated by the Machinery Division. Its equipment consists of eight 900 and one 100-hp. boilers, two 5000, one 2684, one 100, and one 8000 cu. ft. per minute air-compressor, one 1000, two 500, one 3750, and one 5000-kva. generator, three exciter-sets, two motor-generators, and two rotary converters as well as fire-pumps, hot-water pumps, and other auxiliary equipment.

Hull Division

The principal shops of the Hull Division are the mold-loft, paint-shop and paint-manufacturing plant, boat-shop, oxy-acetylene plant, forge-shop, pipe-shop, sheet-metal shop, shipsmith shop, drop-forge shop, galvanizing shop, shipwright and spar shop, rigging-loft, sail-loft, flag-loft, joiner-shop, and shipfitter-shop.

Boat-Shop

The capacity of the boat-shop is best indicated by the statement that during the 18 months of the War, 900 boats were constructed, 400 of these being 24 ft. long or under, and 500 from 24 to 50 ft. In addition, the shop constructed fifteen 110-ft. submarine chasers and three 50-ft. motor tugs.

Paint-Shop

The paint-shop was completed in 1917. It is one of the most modern and efficient paint-manufacturing plants of the Navy Department, and is of sufficient capacity to manufacture all Government paints for the Pacific Coast and stations in the Islands. During the last few months the daily average output of manufactured paints has been 1800 gallons, besides 3000 lb. of putty and oil-stop compound.

Floating-Crane

This crane, which is of the rotating luffing-screw type, is mounted on a steel pontoon and has a capacity of 150 gross tons, at a radius of 105 feet.

Oxy-Acetylene Plant

This plant is devoted to the manufacture of oxygen, hydrogen, and acetylene gas. The shop operates 24 hours per day and has a daily capacity of 22,000 cu. ft. of hydrogen, 11,000 cu. ft. of oxygen, and 5000 cu. ft. of acetylene gas. Oxygen and hydrogen are generated by the electrolytic process.

Structural Shop

This building is at present under construction, and, when completed, will house many activities now scattered about the Yard. It is constructed in three bays, is 300 ft. wide by 700 ft. long, and will include a plate-shop, an angle-shop, and a forge-shop. The easterly bay has a second story to provide a mold-loft 100 ft. wide by 700 ft. long, which will make it the largest mold-loft on the Coast.

These shops are of the Department's standard design for the fabrication of material for the building of capital ships. The material stowage for plates and angles is at the south end. It will be provided with eight 10-ton bridge cranes, each having a span of approximately 85 ft., the total length of run for each bay being 485 ft. The armor and billet stowage is on the west side and is to be provided with a specially built 80-ton gantry crane, or equivalent capacity, with a span of approximately 80 ft. and a 700-ft. runway. The material for fabrication will enter at the south and pass out at the north end of these shops to a double standard-gauge track connecting with the main track running to the building-slips. The

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main equipment of the angle-and-shape shop consists of two angle-furnaces, one 80 ft. and one 40 ft. long, a bending slab 83 by 95 ft., hydraulic angle-presses, punches, etc., and a space devoted to oxy-acetylene and arc welding. This shop is provided with one 15-ton electric traveling bridge-crane, and four 5-ton, and two 3-ton electric traveling wall-cranes.

Forge-Shop

The large forge-shop is equipped with one 2000-ton forge-press, and one 800-ton forge-press (air-driven). These presses are provided with large billet-furnaces, capable of heating two 40-in. billets. There are also two annealing-furnaces, one with a chamber 5 by 6 by 60 ft., and the other with chambers 3 by 6 by 12 ft. This shop is capable of manufacturing the largest shafts and forgings for capital ships. There are four large hammers of a capacity respectively of 6000 lb., 4600 lb., 4000 lb., and 3300 lb. each, with billet-furnaces. Each hammer is provided with an individual electric-driven jib-crane, ranging from 15 to 10-ton capacity.

At the south end of this bay there is a drop-forge department consisting of a 2500-lb., a 2000-lb., and a 1500-lb. air-driven drop-forge hammer, with trimming presses, also one 1200-lb. and one 800-lb. electric-driven board drop-forge hammer with trimming presses, together with a large assortment of drop-forge dies. This bay is provided with one 80-ton and one 15-ton bridge-crane and four 5-ton wall-cranes. The smaller bay is equipped with 70 hand-forges and 11 air-driven hammers ranging from 250 to 1200 lb., a tool-dressing department, and a rivet and bolt forging department. This shop is provided with a 15-ton overhead electric crane running the entire length of the shop.

Dry-dock No. 1 was commenced in 1872 and finished in 1891. It is of granite and concrete and cost $2,772,000. It is 122 ft. by 508 ft. and has 26 ft. of water over the sill at high water. One hour and 30 minutes is required to fill it and one hour and 55 minutes to pump it out. Dry-dock No. 2 was commenced in 1899 and finished in 1910. It is of concrete and cost $1,556,000. It is 120 by 740 ft. and has 30 ft. of water over the sill at high water. To fill it takes one hour and 40 minutes and to pump it out, one hour and 35 minutes.

The increase in the operations of the Yard during the past six years is illustrated by the fact that in 1914 the cost of material used was less than $2,000,000 and the value of the product a little over $4,000,000, while in 1920 the cost of material will exceed $12,000,000 and the value of the product will be nearly $29,000,000. Only four vessels, of an aggregate value of $2,755,000 were under construction in 1914, while at present there are, under construction at the yard or authorized, two battleships and eight destroyers, of an aggregate value of $42,250,000.

During the past six years there have been constructed or authorized at the Yard two battleships, three fuelships, sixteen destroyers, fifteen submarine-chasers, and nineteen small craft, 55 vessels in all. In 1914, 58 vessels, exclusive of Yard craft, were docked and repaired at the Yard. During the fiscal year ended June 30, 198 vessels, exclusive of Yard craft, were docked and repaired. In December 1914, 2426 civilians were employed at the Yard. In November 1919, 10,545 civilians were employed. The number employed at the present time is nearly as great. More men are employed at the Mare Island Navy Yard than at any other Navy Yard except the one at New York. During the fiscal year ended June 30, 1920, Mare Island ranked all the other Yards in economical production.

Standardizing of Gray-Iron Samples*

By EDWARD J. FOWLER

In the field of gray-iron products, or at least cast products in which the ratio of the combined and graphitic carbons play an important part, there is a woeful complexity of sampling methods, which should compel attention for the purpose of arriving at some method whereby records from varied sources will gradually create an interest in the importance of the carbon ratios for the benefit of the trade and for the establishment of true analytical records.

At present, without a recognized standard, the average foundryman takes his sample from various parts of castings. While the usual metalloids do not vary to any important extent, the carbon ratio is dependent almost entirely upon the cooling-rate of the casting. If a sample is taken from a half-inch section of a long flat plate the combined carbon differs from a similar half-inch section closer to a heavy section with tendency to delay the cooling effect of the sand; in fact, the combined carbon content materially differs in half, three-quarter, or one-inch sections so that the foundryman must not only direct that a sample be taken but must also signify from what part of the casting such sample should be taken. In recording such results he is confronted with the necessity of a complex description of where the sample was taken. He may direct that a sample be taken from a pulley, and if the pulley happens to be on the boring mill the chips are used for a sample, and may give a reasonable indication of the carbon ratio. On the other hand a sample taken from a rim or spoke may show a ratio that would explain some defects of mixture easily remedied.

It perhaps is unkind to say that practically all of the published carbon ratio determinations are useless; but

*From a paper presented before the American Foundrymen's Association at Columbus.

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this is at least a half truth when one considers the distrust surrounding a result that is not supported by some statement showing where the sample was taken.

Frequently a foundryman who prides himself upon good practice and complete records, publishes carbon ratios showing a cylinder analysis of, say, combined carbon 0.60%, graphitic carbon 2.60%, together with a pulley showing combined content of 0.80% and graphitic carbon 2.40%. This is good as far as it goes, but where was the sample obtained?

It has taken many years for foundrymen to assimilate the fact that not only is the total carbon of interest so far as material going into the cupola is concerned but that the carbon ratio is important in the product. Even now some pig-iron producers set forth the combined and graphitic analysis of their pig as proving that with low combined carbon in the pig, the foundryman can get low combined carbon in his castings.

This fallacy is fast disappearing with the growing importance of the semi-steels, the air furnace, and the electric furnace, whose results are so dependent upon the total carbon and the consequent ratio of combined to graphitic. Therefore, now as never before, we should be accumulating carbon records, which gradually will build up a theory of the composition of cast-iron that will be of great benefit to the trade.

Cast-iron at its best is a conglomerate mixture of various metalloids and compounds with various melting points, all coming down in an apparently liquid stream, which in reality consists of a melted fluid carrying along with it pasty compounds of varied composition. These affect results and cannot be determined by the chemist in the usual commercial analysis. With the prevailing high working-temperatures, we are discovering new and better irons; largely by the complete melting of such compounds so that their influence can improve the mixtures directly.

These facts are cited for the purpose of calling attention to at least one reason for a standard-analysis sample casting. For some years I have consistently pursued the plan described below.

First it seemed possible and desirable to take a part of the physical bar for this purpose, but this was discarded for the reason that for some purposes the American Foundrymen's Association round bar was used, for others a 1 by 1 by 14-in. bar for 12-in. centres; and also the 1 by 26 in. for 24-in. centres; to say nothing of the round and square coupon-bars desired at times by various engineers.

Second, the sample should be poured in green sand at all times in order to obtain comparable results, or in dry sand if such practice was to become standard.

It finally was decided that a green-sand sample or plug would be most simple and desirable for average foundry practice and the following plan has been in force for about eight years. Eight to twenty plug-patterns are made depending upon how many samples are generally desired. These plugs are $1\frac{1}{4}$ by $1\frac{1}{4}$ by 4 to 6 in., each plug-pattern having a pattern letter on the bottom, 1, 2, 3, etc., showing on the cast plug. The plugs are molded on end in a drag, no cope being used, are molded in succession 1, 2, 3, etc., and are separated about 6 in. from each other to prevent undue results on account of the influence of heat from plugs already poured. The foreman directs that plug No. 1 be poured from the third tap; No. 2 from the sixth tap, etc.; or a plug can be poured from each tap if a special check is required. Bars for physical tests are poured separately. This requires no special direction from the office other than the order 'take bars and plugs today'. Each plug is poured down the mold without any gate. When the drag is shaken out we have a series of numbered plugs, which are brushed to remove all sand. Drillings are taken on the side and put in envelopes numbered to conform with the plug numbers. These envelopes are sent to the office for record and analysis.

As a general rule a composite is made for the laboratory sample, consisting of an approximately equal amount of drillings from each envelope, but the envelopes can be saved and any part of a heat can be checked if required.

The plan is susceptible to varied changes to suit local conditions or special tests without the necessity of any involved instructions. All analyses are comparable with the results of earlier years, which is particularly desirable as records increase. The net results of checking are that where a plug-sample has given 0.60% combined carbon the same iron in one kind of casting has always run 0.80% and in another 0.50%, so that from our plug results we can often determine that the machine-shop should improve its tool practice. Moreover, the records show that, say, a 0.60% combined carbon gives certain results in certain castings; and further if a standard plug is used, all printed records can be referred to as American Foundrymen's Association standard.

It may well be that some better form of sample or some better method can be devised than the plan herein proposed, but in any event I believe the American Foundrymen's Association should make an investigation and propose a plan whereby accuracy in this respect may be assured, thus removing the general prevailing idea that the foundry is the father of inaccuracies and that a molder knows no closer measurements than the quarter-inch marks on the face of a rule.

TWO FOOTPADS attacked a man the other day, who resisted so vigorously that he was not subdued until completely knocked out. Search of his clothes yielded only 15 cents. When he recovered consciousness, one of the thieves asked: "Is this all the money you have?"

"Yes," he replied weakly.

"Well, I believe you," said the thug, "but would you mind telling me why you put up such a scrap if that was all you had on you?"

"Thunderation, man," the victim responded, "I was trying to protect my credit."

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Putting the Sick to Work

By H. A. PATTISON*

So long as there are 1,000,000 active cases of tuberculosis in the United States, so long will the problem of making this group of invalids and potential invalids self-supporting be one of supreme economic importance to the country. The problem involves two essentials: first, the cure or partial cure of the consumptive; and second, the adaptation of the cured or apparently cured patient after sanatorium or home treatment to a job that will be remunerative, but still within the limits of his strength.

We know how to cure tuberculosis. Provided the discovery of the disease is made early enough, a large percentage, probably 75% and over, can be cured or restored to 'walking strength'. We have not solved the second part of the problem—that of putting the tuberculous man or woman back as a full-fledged wage-earner, economically independent, as any real wage-earner should be.

Statistics of the Trudeau Sanatorium, one of the oldest tuberculosis institutions in the world, show that 61% of the discharged patients were well and working after from one to ten years. This is a most encouraging figure. Yet we hope to see still more, perhaps all, well and working indefinitely. Dr. Joseph Pratt, of Boston, who has treated successfully large numbers of patients in their homes, says that after a similar length of time 56% were well and working. There is a great advantage about sanatorium treatment, yet these figures show that failure to continue well may follow even the best of 'cures' provided the after-life is not carefully conducted. The 39% who were not well and working were probably in as good condition as the others when they left the sanatorium. Something happened to them after they left. A man who has had the advantage of sanatorium treatment usually is himself at fault if he does not remain well after being discharged.

Since work occupies most of the waking hours of most people we are compelled to believe that the patient's habits of work must have a good deal to do with his failure to remain well. Many data have been gathered about the right kind of work and the wrong kind for a returned tuberculous patient to do, but the probable correct solution to the question has not been given. Summed up, medical authorities are now agreed that almost any kind of work to which the patient is accustomed is safe to resume after treatment, if it is done in the right way and the right amounts.

There are those that advocate a complete change of vocation. This is often entirely unnecessary, and may mean considerable hardship if the patient must support his family on the income from a vocation which he is learning. Usually the wisest thing is to return to the old job, unless it was one that plainly was responsible for the first break in health. Doctors should be given an opportunity to judge of this.

Those jobs that are done in dark, damp, dirty, or dusty places should be avoided, as they should under any circumstances, whether a man is tuberculous or not. Those that make too great a demand on the patient's strength, or require too long hours, will tend to cause a breakdown. A job that enables him to be free from financial worry is better than one that may be somewhat more healthful in its conditions but will not support him.

There are usually sixteen hours in the day when an individual is not working. If he looks out for these hours as he knows he should, he will be able to work in ordinarily sanitary occupations with success. A short hurried lunch-period, and a long trip to and from work during the crowded hours may spoil any job. A man that can live near enough to his work to walk to and from it, and who can get a good lunch, is likely to be much better off. The large cities make life pretty strenuous.

A person should be without active symptoms before returning to work at all. The earlier he returns, the more careful he should be. It is often advised that a man start on part-time if possible. In most cities, however, part-time jobs are rare. In Cleveland there is a working-supervisor, who helps to get returned tuberculous patients this kind of work. All cities should have such an officer.

Many people are advised to get light work on a farm. This is a hard thing to find, as farmers will tell you. Farm-work to which a man is not accustomed, is likely to put much too great a muscular strain upon him, and muscular strain is a thing to be avoided. Furthermore it will usually entail more exposure, longer hours, lower pay, and worse home conditions than the work for which a man has been trained.

If a man is inclined to blame his work for his ill health, he should consider whether it is not possibly some condition surrounding it, or some condition at home, or some habit of his leisure time that is to blame. I knew a young returned soldier that changed his job on his own account, with a reduction of half in wages, in order to improve his health, but he continued in the same condition. Finally he was advised that if he would go to fewer dances, play outdoors instead of attending the movies, eat regularly, and sleep more, he would perhaps notice an improvement. This is exactly what happened. His health is better and he is just as happy.

A man should keep in close touch with his doctor, and if it seems that his work is really too heavy for him, or if the surroundings are not sanitary, he should make a

*Medical field secretary, National Tuberculosis Association, New York.

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change regardless of the financial loss, for he has many years to live and work, if he lives and works wisely. It is better to get started right at once, rather than to take a chance on a return of the disease.

Every man in a sanatorium, just as every man in jail, thinks with longing of the time when he shall be released, and plans what he will do. Let him not plan any such career as the following patients did, for they all had to return for another stay at the sanatorium. The first man had a year's leave of absence from his work. He was discharged, the tuberculous condition being arrested after eleven months treatment. He spent the final month in going on a round of visits to his relatives, having a wonderful time, until he began to have his old symptoms again. Another man went home on Sunday, started in work on Monday, worked all day that day, and went to the movies with his wife in the evening. This he continued for thirteen days more, and on the fourteenth he went to the hospital with a serious complication. A third, a girl, lost her job on account of illness. Upon her return from the sanatorium she spent many long days, walking streets and climbing stairs looking for another job. Because money was scarce, and she felt the need of putting on a good appearance, she denied herself food and bought clothes instead. She went back to her old diet of coffee and eclairs, purposely ignoring all she knew about diet. Finally she picked a job in a most unhygienic factory because she knew some girls there. She worked in that factory a month, and then was taken back to the sanatorium.

Tuberculosis is largely a problem in living. Before we conquer the disease we shall have to learn to live so as to prevent it, or to cure it, or to keep well after getting well. The compaign which is largely financed by the sale of Tuberculosis Christmas Seals has been for the past 15 years the most important organization working for the education of the citizens of the United States into the health that means freedom from tuberculosis.

In the 'seventies and 'eighties, the bottom land along Kings river, like that along most of the other streams of the San Joaquin valley, was an unreclaimed swamp, full of tules and willow thickets. Through this wilderness wandered droves of semi-wild hogs. Naturally, disputes regarding ownership of some of these hogs occasionally arose. Sometimes a dispute of this character was carried to the courts. In one of these suits, a hog-raiser named Fred Jones, an old-time resident of that part of the country, was summoned by the defendant as an expert witness. The plaintiff's attorney was a very pompous man, who had become rather unpopular because of that quality. Jones had a reputation for dry humor, and when he was called to the stand, there was more than the usual crowd in the courtroom, as it was expected that the cross-examination would be entertaining. The direct examination passed without incident. The cross-examination was somewhat as follows:

"What is your occupation, Mr. Jones?"

"Nothing. I raise hogs mostly."

"Are you acquainted, Mr. Jones, with the brands in this district?"

"Know every d——n one of 'em, sir."

"What is your brand, Mr. Jones?"

"Smooth-cropped ear on the side next to the river."

(Considerable excitement in court. Judge raps for order, which is finally restored.)

"Did I understand you to say, Mr. Jones, that your brand is a smooth-cropped ear on the side next to the river?"

"That is what I said."

"Now, Mr. Jones, suppose that you were going through the bottoms, and should find a hog with a smooth-cropped ear on the side next to the plains?"

"Well, doggone it, couldn't I turn him?"

The examination proceeded no further.

A Fable in Business

A rabbit sat in his burrow listening to the roars of a lion. When the lion roared all the other animals stopped to listen. The rabbit asked the lion how it was that he made such a great impression on the other animals.

"It is because I roar loudly and so often," replied the lion. "If you would only come out and roar like me, you would find that all the animals would be impressed by you also."

Mr. Rabbit, very much flattered, came out and tried to roar, but all he could do was to squeak, whereupon the lion picked him up and took him home for dinner.

"Before I die," said Mr. Rabbit, "please tell me how it was I failed."

To which the lion replied: "It pays to advertise, but you've got to have the goods."—Women's Wear.

The happy couple were on their way to New York. They had to change trains at Providence, and an obliging porter, while struggling with their baggage, made mental note of the fact that the young woman's hair was dotted with rice.

Presently he approached the glad young man, and pulling a folded paper from his pocket, said:

"Here's a present for you, sir, with the company's compliments."

"Indeed!" said the traveler. "What is it?"

"A railway map, sir."

"Oh, thank you; and what are these marks in blue pencil?"

"There's the beauty of it, sir," said the smiling porter; "those marks show just where the tunnels are, and their length."—Los Angeles Times.

The ground plan of this story is, we admit, almost as old as the everlasting hills, but the superstructure is relatively new. It is said that an escaped convict dashed wildly into the office of the lawyer that had defended him, declared that he was being followed by the police, and asked the head clerk where he could hide.

"Get into the simplified card-index case," said the clerk quietly, "I defy anyone to find anything there."

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Testing Welds*

By S. W. MILLER†

The testing of welds has been studied since welding was known, especially during the past five years. Its importance has now become great. There have been failures in the past, many of which have not been explained and some of which have been expensive. As in all other developments, welding first received its principal impetus from the practical man. Recently, however, the tendency has been to investigate it more carefully and more fully and by means not available to the ordinary welder. Scientists have been called into consultation to determine what methods and materials would make the best welds from a standpoint of security, service, and cost. While some of the methods employed at present are beyond the reach of the ordinary welding-shop yet they are of great value and, in fact, are necessary in order to determine correctly what has occurred during the welding operation and what results may be expected under given conditions. Serious criticism of most of the published results can be made because of their incompleteness in one or more respects, and one of the things that the American Welding Society proposes to do is to put the testing of welds and welded structures on a firm and safe foundation.

The testing of metals, aside from welds, is well developed both in theory and practice. The most common test is the tensile, which gives the tensile strength, the yield point or elastic limit, the elongation, and the reduction of area. Compression, torsion, shock, and alternating-stress tests are also used and the two latter are employed much more often than in the past because materials may give high results in the tensile test and yet be unsuitable for service where shock or alternating stresses are met. Another common test is bending, either hot or cold, to a certain radius.

The microscope is a help in the study of metals, and is a necessary instrument in all laboratories. Its principal function is to determine the extent and position of impurities in a metal, to determine whether or not the structure is proper for the purpose desired and whether or not various heat treatments will give satisfactory results. While no one method of test shows everything desired to be known, the microscope is probably the most powerful single instrument of investigation and, in the study of welds, it is particularly valuable because of the method of their formation. A weld is a casting and is subject to all the defects found in castings, which are, however, exaggerated in the case of welds.

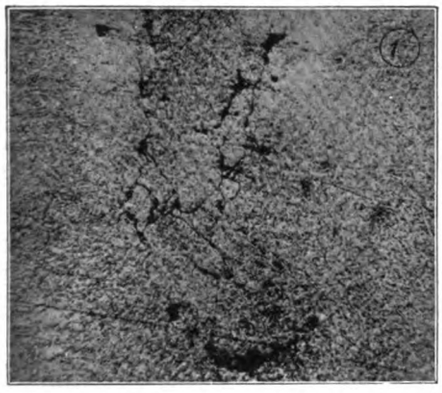

Fig. 1. Flaky gun-steel. Films of oxide or slag, which weaken the metal and prevent it passing test.

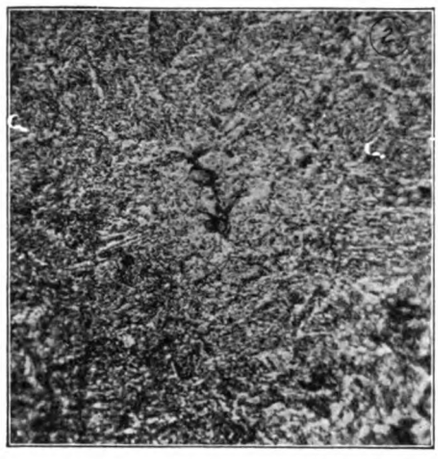

Fig. 2. Strained piece of gun-steel showing rupture beginning at small defects, two small dots of manganese sulphide.

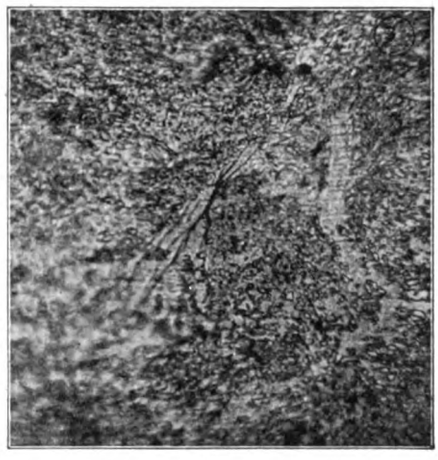

Fig. 3. Another piece of strained gun-steel. Rupture occurs here in a streak of ferrite, which contains no carbon, and so is weaker than the rest of the material.

I will confine my talk to the welding of steel plate by the oxy-acetylene and the metal-electrode processes. Let us also assume that the welds we are to consider are in some important structure so that soundness and high quality are necessary. By soundness, I mean freedom from mechanical imperfections such as lack of fusion, the presence of films or other inclusions, gas-pockets, slag, etc. Welds of inferior quality may answer some purposes admirably, and, if they do, there is no use in making better ones, but this is not the goal at which to aim. The welding of steel is frequently considered as not being especially difficult. The opinion is also expressed sometimes that steel is steel and that no different treatment is required for different qualities and varieties of steel. This idea is much less common today than it was several years ago, but it is still too prevalent for the good of the art.

A comparatively small difference in the percentage

*Paper read at the September meeting of the Chicago Section of the American Welding Society.

†Rochester Welding Works, Rochester, New York.

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of carbon in the material being welded makes a great difference in the results of either a bending or a tensile test. If the carbon content is 0.12% or less, the material is soft and ductile, and yields readily to any strain that may be put on it. Such material is frequently used for tanks and because of its ductility and comparative freedom from damage by heating, is admirably suited for welding. Structural steel, bar-steel, and boiler-plate contain about 0.15 to 0.25% carbon and have a tensile strength of about 60,000 lb., while the soft low-carbon material has a strength of 52,000 to 55,000. Ship-plate is required to have a tensile strength of 58,000 to 68,000 lb. and in the heavier sections requires as high as 0.30% carbon. The higher the carbon, the more difficult it is to get a satisfactory weld and the more danger there is of injuring the metal being welded. Furthermore, the strength of a weld must correspond to that of the welding-rod or electrode used to make it. If this strength is greater than that of the material being welded, the test piece will break outside of the weld. If, on the other hand, the weld is weaker than the material being welded, rupture will take place in the weld. An oxy-acetylene weld made with ordinary low-carbon welding-wire will have a tensile strength of about 52,000 lb. This is stronger than soft tank-steel and weaker than the other materials mentioned. With alloy-steel rods of proper composition a tensile strength of about 50,000 lb. may be obtained in an oxy-acetylene weld. Neither of these materials will weld boiler-steel, boiler-plate, or ship-plate so that the rupture will occur outside the weld when the section of the weld is the same as the section of the piece. Therefore, in making tests of welded pieces, it is necessary to know the character of the material being welded, because if Jones makes a weld in soft tank-steel and Smith makes one in bar-steel, the first will break outside the weld and the latter in the weld, with the probable

Fig. 4. Armco iron strained. The curved lines are not cracks, but the edges of parts of the grains that have slipped past each other, so that the surface of each grain is stepped, as would be the top of a row of books that had slid past each other. In some grains there are two sets. They are called slip-bands.

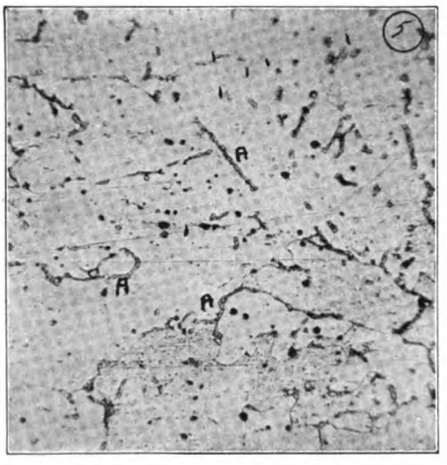

Fig. 5. A better oxy-acetylene weld than Fig. 6, but in the same material. Note the absence of iron nitride lines. The small dark dots are iron oxide, and they appear in all welds. The bands A at the grain boundaries are carbide of iron, or cementite, and contain all the carbon in the steel. There are more of them than in Fig. 6, showing more carbon present, and also that the metal was not as hot as in Fig. 6, because overheating burns out the carbon.

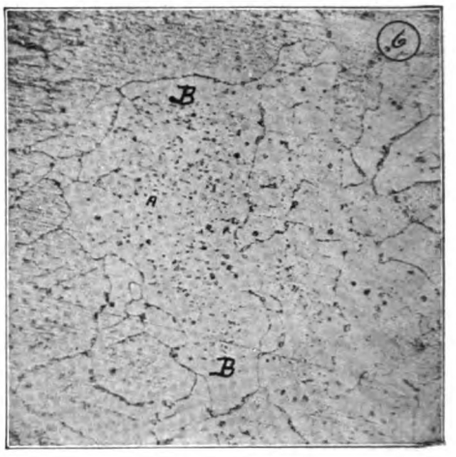

Fig. 6. A good looking oxy-acetylene weld, but made with too large a tip, as shown by the short straight lines in some of the grains, as above and below A, in the large grain B. These lines are iron nitride, and indicate absorption of both nitrogen and oxygen by the overheated metal. The grain boundaries are the irregular curved lines.

Fig. 7. Slip-bands in good oxy-acetylene weld, stopping at grain boundaries.

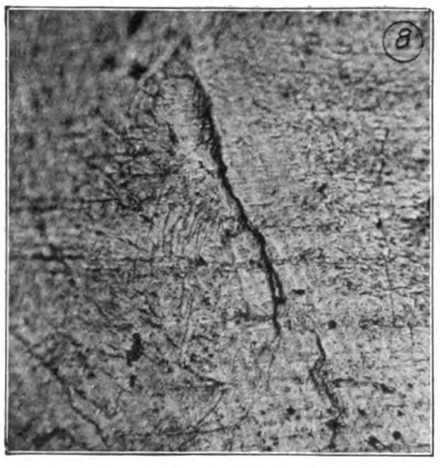

Fig. 8. Oxy-acetylene weld showing heavy slipping at grain boundary. This is not a crack, but shows a weakness there.

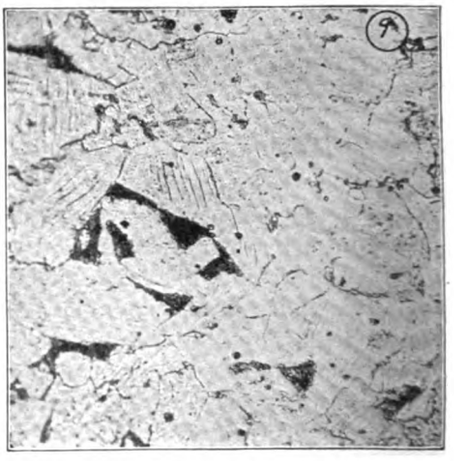

Fig. 9. Good oxy-acetylene weld made with rather high carbon steel, as shown by the pearlite grains A. Note presence of slip-bands in all good welds, and their absence in bad ones.

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result of adverse criticism of Smith's work. The method of test to be applied in any given case depends largely on the use to which the welded piece is to be put. If it is to be used in a pressure-vessel, I believe that not only weld tests, but it is advisable, whenever possible, to follow those of the American Society for Testing Materials. Inasmuch as a welded piece is not of uniform character, it is not possible to use the elongation and reduction of

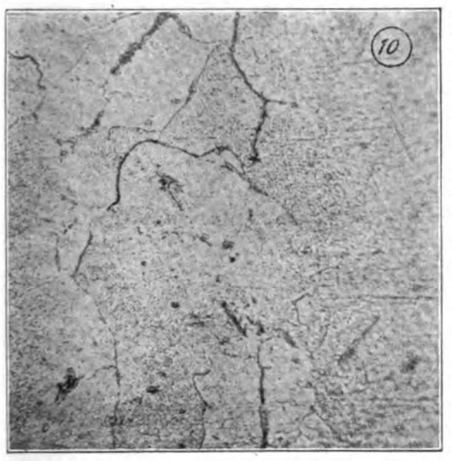

Fig. 10

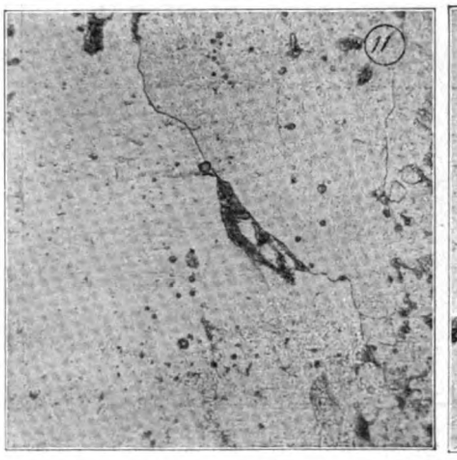

Fig. 11

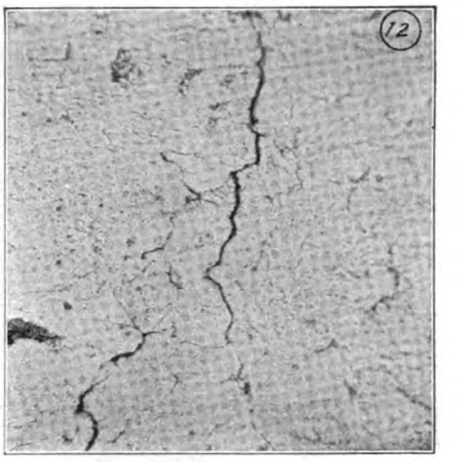

Fig. 12

Fig. 10. Inter-granular cracks in strained oxy-acetylene weld.

Fig. 11. Film of foreign matter, probably oxide, in oxy-acetylene weld.

Fig. 12. Inter-granular cracks in strained oxy-acetylene weld. No defects visible before straining, showing that films were thin.

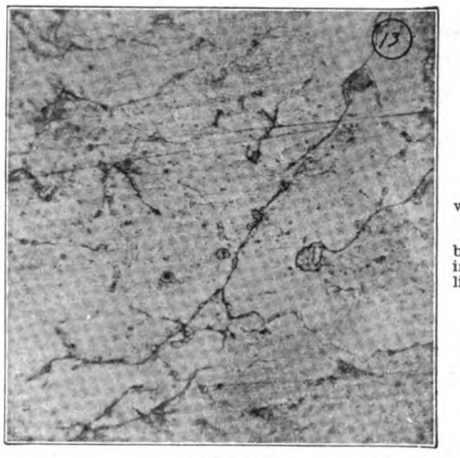

Fig. 13

Fig. 13 and 14. Visible defects in oxy-acetylene weld before and after straining.

Fig. 15 and 16. Are the same field, Fig. 16 being strained more than Fig. 15. Rupture is inter-granular. Note in Fig. 16 that upper part is lifted out of the lower.

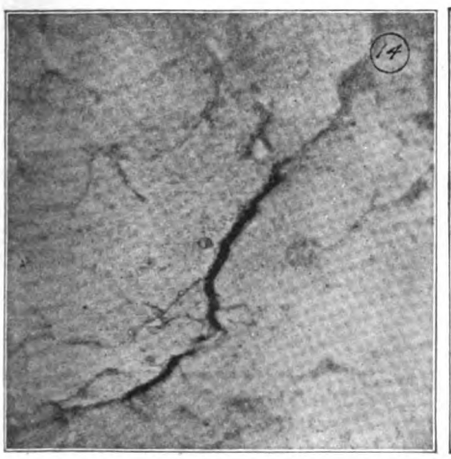

Fig. 14

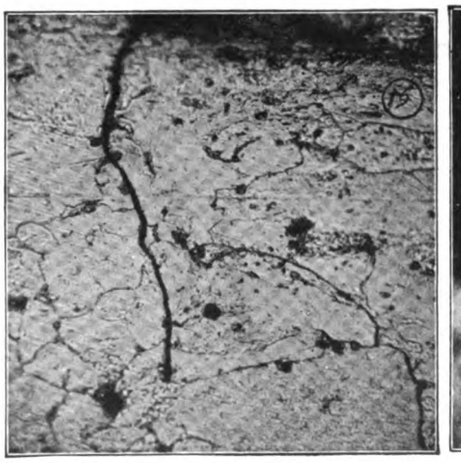

Fig. 15

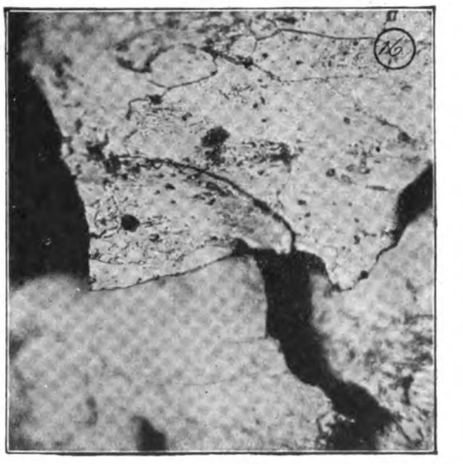

Fig. 16

should a tensile test be made, but that an alternating-stress test should be used because of the breathing of the tank on account of the changes of pressure. This latter test should also be applied where the weld is subjected to bending strain. There are no standards at present for area as commonly measured. Where the break occurs in the weld, the elongation of the whole test-piece tells little about the quality of the weld. My practice is to take the elongation in each inch, two inches, etc., of the gauge-length, beginning at the centre-inch, which in-

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cludes the weld, and to plot these figures against the gauge-length. Evidently, when the break is outside the weld, the various physical characteristics determined are those of the original material and not of the weld. The best test, in my opinion, to determine quickly the general character of a weld, is to grind it level with the surface of the pieces and clamp it on an anvil, with the centre of the weld level with the top of the anvil and the bottom of the V toward the anvil so that the top of the weld is stretched when the projecting end is struck with a sledge. The blow should not be too heavy and the number of blows and angle to which the piece bends before cracking are a good index of the value of the weld. It is true in this test, as in the tensile tests, that the quality of the material being welded has a great influence on the results. Stiff material throws more of the strain into the

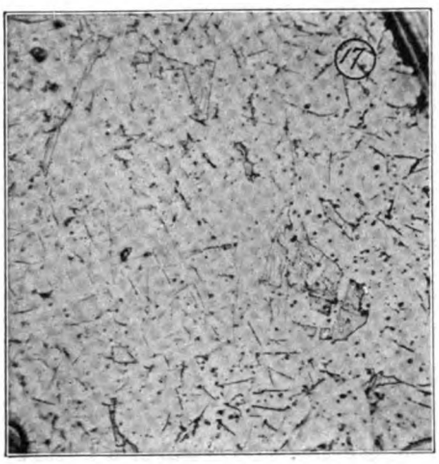

Fig. 17

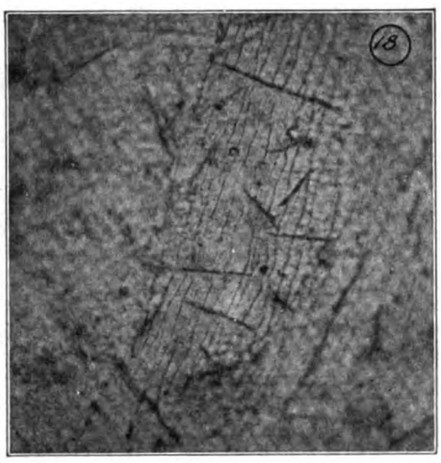

Fig. 18

Fig. 19

Fig. 17. Arc-weld made probably with too long an arc, as there should not be so much iron nitride.

Fig. 18. Slip-bands in arc-weld. The heavier straight lines are iron nitride. These weaken the weld little, if any, because the slip-bands usually stop at them, as at grain boundaries.

Fig. 19. Good part of arc-weld heated red-hot and slowly cooled. Distortion is by slipping as in normal steel. Large dark spot in centre is iron nitride.

Fig. 20

Fig. 20. Metallic arc-weld heated red-hot and quenched. No appearance of defects.

Fig. 21. Same weld as Fig. 20. There was no defect visible before strain. Ruptures are intergranular.

Fig. 22. Another view in weld Fig. 20. Ruptures are partly at a globule, the unbroken oxide film showing at the bottom, and partly where no defects showed.

Fig. 23. Large defect in arc-weld. Dark streak is oxide of iron.

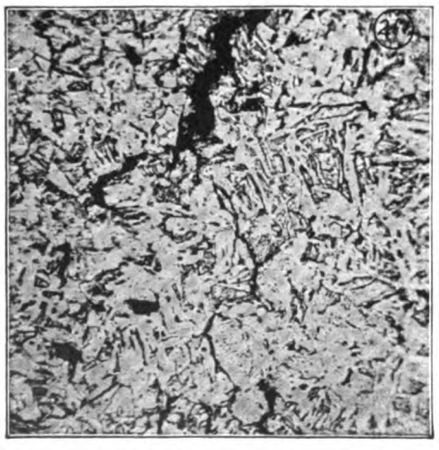

Fig. 21

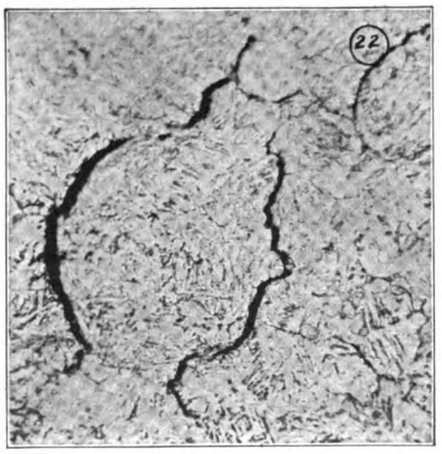

Fig. 22

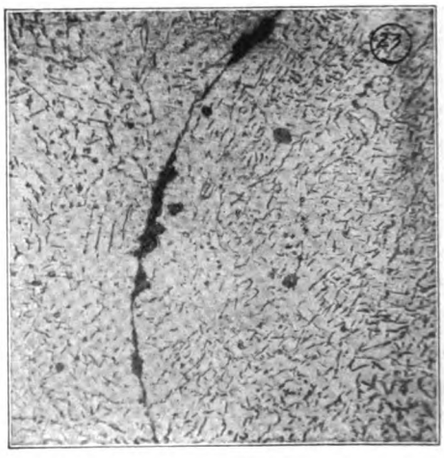

Fig. 23

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weld, while soft ductile material will itself take much of the bend. With defective welds, that is, those not fused along the V or which contain slag or other inclusions, this test will at once develop the defects. If a welded piece were to be used in place where it might become red-hot, such as, for instance, in a locomotive fire-box crown-sheet, the weld might properly be tested at a red heat. I believe that it would be of interest to all of you to test some of your welds by clamping them in a heavy vise or on on anvil with the centre of the weld about half an inch from the edge of the table or above the face of the anvil, heating them to a bright orange with the torch and then bending them as before with a sledge.

If such welds are made in half-inch by two-inch bar steel, a 90° single-V weld being used, and they bend to a right angle cold without cracking on the outside, a welder may feel satisfied with his work.

There seems to be a definite relation between the thickness of metal, the size of tip, and the size of the welding-wire, in gas-welding, and between the thickness of metal, the diameter of the electrode, and the current used, in electric welding. It is also true that electric welds, except possibly those made with covered electrodes, will not stand as much bending as oxy-acetylene welds.

In many cases, the defects in welds are visible to the naked eye when tested. In others, they are not, and while it would seem plausible that the visible defects were the more dangerous, yet to my mind, the hidden danger due to the ones that are hard to see is a matter that must not be overlooked. For many years, the dan-

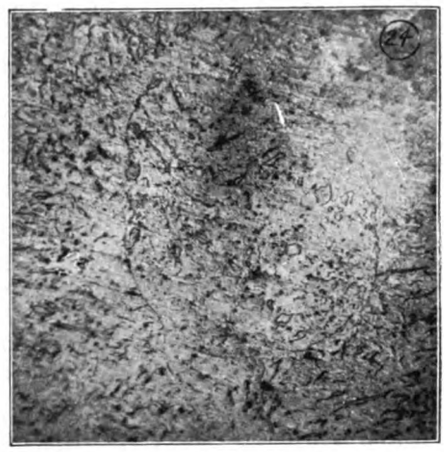

Fig. 24. Globule in arc-weld about 1/300 in. diam., surrounded by a film of oxide about 1/8000 in. thick. This is a weak spot in the weld, and such spots give first under strain.

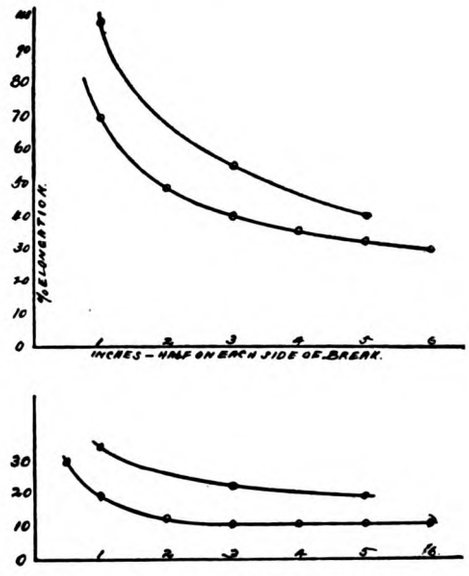

Fig. 25. The upper pair of curves show the difference in elongations of two pieces of steel of the same tensile strength. The upper curve shows the more ductile piece. The lower pair of curves show the elongation measured the same way, of welded test-pieces of the same materials, the upper curve being in the more ductile material. Thus it is necessary to know all about the materials being welded before comparisons of welds can be fairly made.

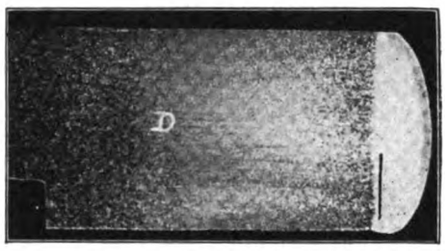

Fig. 26a

Fig. 26a. Oxy-acetylene weld in 0.50% carbon shell-steel made with Roebling 'o-a' wire.

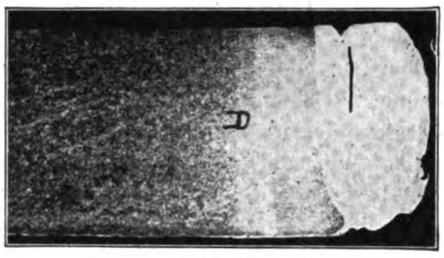

Fig. 26b

Fig. 26b. Oxy-acetylene weld in shell-steel made with shell-steel.

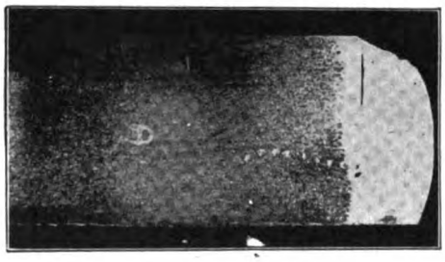

Fig. 26c

Fig. 26c. Arc-weld in shell-steel made with Roebling electric wire.

Fig. 26, a, b, and c. In all cases the black line shows the original surface, and the white parts contain little carbon. The heat effect extends to D in each case. The decarbonization of the original material and the change in structure, even if the weld were sound, would be a defect in some cases. Note that even where 0.50% carbon-steel is used for welding, there is not much carbon left in the weld. Also that the loss of carbon is greater with arc-welding than with oxy-acetylene.

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gerous defects in steel rails have been those that were not visible, and that have usually been very small at the start. During the War, when the demand for gun-steel was heavy, so-called flaky steel was the material that gave the Government the greatest cause for concern. In fact, those who are best posted on the metallurgy of steel are paying more and more attention to the minor defects, which heretofore have been considered of but little importance. This is equally true for welds and in determining what a welder can do, this is one of the things that should be examined carefully. A. M. Waring has recently developed a method of testing rails for these hidden defects. It consists of deeply etching a polished surface of the material under test. For instance, a section of a weld may be cut with a hack-saw, machined, or filed to a true surface, and polished on various grades of emery-paper, ending up with 00 Manning. It is then placed in a warm solution of 25% hydrochloric acid and water for half an hour to an hour. The acid will eat away the defects, making the edges of the material taper at these points, so that rather large grooves and pits will be visible where the defects prior to the etching were only microscopic. It is not necessary to warm the acid, but the procedure takes longer when it is cold. The bending-test, hot and cold, and the etching test, I consider to be the best for ordinary shop practice.

Some of the defects in welds are visible under the microscope, but others are not visible until the weld is strained. A small bending-machine that can be placed on the microscope stage is very useful, because, after etching, the piece can be bent and examined to determine the effect of the strain. In the case of bare-wire electric welds, the rupture, as far as my experience goes, always occurs at the grain boundaries even where no defects are visible there at the highest powers of the microscope. Of course, where there are visible defects, the rupture takes place first at these. Where there are no defects, the distortion occurs by slipping in the grains as in normal steel. In my opinion, the cause of these defects is almost always oxides of one or another constituent of the metal, but usually of iron. There is no positive proof of this as yet, but there are indirect proofs. An electric weld that will bend very little may be made more ductile by heating in a reducing atmosphere at a low red heat for one or two hours, indicating that the weakness at the grain boundaries has been removed, and that the material at the grain boundaries was an oxide. Again, heating an electric weld in an oxidizing atmosphere makes it more brittle. These treatments affect oxy-acetylene welds in the same way, but the change is not so noticeable.

These rough tests, while satisfactory for determining the general quality of the work, do not answer as a basis for design, and more refined tests must be used, as has already been mentioned. I believe that the most important of these are the tensile and alternating-stress tests. The tensile test can be made in any shop provided with the usual tensile-testing machine. The alternating-stress test is not as yet standardized, even for unwelded material. I am inclined to believe that the machine devised by the Quasi-Arc Co. is of considerable value, although it does not give absolute results, that is, it does not give the amount of fibre-stress to which the piece is subjected. During the War, the electric-welding committee of the Emergency Fleet Corporation designed and built a machine for testing welds up to $\frac{3}{4}$ in. thick and 8 in. wide by which the fibre-stress could be measured, the idea being to test large sections of welds. The machine has not yet been used. The ordinary machine for determining the resistance to alternating stress uses a small test-piece about $\frac{3}{8}$ by 2-in. section, which is vibrated back and forth at about one thousand alternations per minute. Another machine that will give considerable information is that designed by F. M. Farmer of the Electrical Testing Laboratories in New York. The test piece is round and is rotated under load. With both these latter devices, the fibre-stress can be determined accurately, and, this being known, the number of alternations or revolutions is the measure of the resistance of the piece. The difficulty with these two methods of test is that the pieces are so small that a small defect may cause the piece to break long before a larger piece would, or before a full-sized weld would show any evidence of strain.

A great deal may be learned from the appearance of a weld. It is difficult to describe the appearance of good welds, but after they have been seen a number of times, an inspector can readily determine whether or not the operator knows what he is doing. In gas welding, I would not accept a ripple-weld in heavy material nor one that was narrower than $2\frac{1}{2}$ times the thickness of the sheet, because I have never seen welds of these kinds that were satisfactory. The appearance of properly made electric welds has been well described by O. S. Escholtz of the Westinghouse company and has been published in several trade journals.† The appearance in a gas weld with porosities on top, indicates that the metal has been overheated, and the same thing is true in an electric weld. Inasmuch as I believe that the serious defects in welds are caused by oxides, I would recommend in gas welding the use of a tip no larger than is necessary to produce thorough fusion. This means that the catalogue speeds of welding are impossible if good welds are desired. The same thing is true of electric welds. The reason is that at the high temperatures of the steel caused by too large a tip or too heavy a current, the metal becomes overheated, and in that condition combines more readily with the oxygen of the air or with any excess oxygen in the torch-flame, and produces oxides that are readily dissolved by the melted metal. As the metal cools, these oxides are rejected in large part and pass to the grain boundaries, as do other impurities, so that seriously overheated material is more brittle and weaker than the material that has been properly melted. In conclusion, I have found that great improvement in the quality of the work can be made by using regularly the bending test above described, and by carefully instructing the welders until they are able to make welds that would meet this test.

†See 'Metal Trades', January 1919, p. 18.

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Does It Pay to Mix Iron by Chemical Analysis?

By W. W. ELLIS

The lack of interest displayed by some foundrymen in the mixing of iron by chemical analysis would give the impression to the uninformed that such a practice does not pay. I have noticed that a large majority of foundrymen are perfectly contented to go along from day to day, using the old method of mixing by fracture, which is just guessing at it. Trusting to luck we might say, for that is exactly what it means, especially so when making a new mixture. I have even had foundrymen that are considered up-to-date, and who, of course, think they know all about mixing iron, tell me that you can't make good machinery-castings unless you use 40% pig-iron. They say they always mix their iron on a 40-60 basis. When I hear a foundryman talking like that I don't think he knows much more about mixing iron than his grandmother did, and I am sure there are any number of foundrymen that mix by analysis, and who will back up this statement.

When I talk about mixing iron, I mean mixing iron in every sense of the word. A mixer should know why he uses so much of this or that pig-iron and scrap, and what sort of a mixture to expect from it. He should know why he can expect such an iron from his mixture. Let us analyze the 40-60 statement, and we will very soon see how absurd it is. In the first place, consider the variety and number of different brands of pig-iron on the market. I believe that Church in his two books gives the furnace analysis of more than 200 different brands of iron that are made in different parts of the world. As nearly all of these brands have grading numbers from 1 to 6, there must be several hundred grades of pig-iron of different chemical composition on the market. But let us take only No. 1 irons from a few furnaces. Although the American Foundrymen's Association has agreed to the limits of silicon and sulphur the different numbers shall represent, still can we, or do the manufacturers, follow this agreement strictly? Here you will find that one furnace will produce a No. 1 pig-iron with almost the same chemical contents as the iron another furnace sells for No. 3. So it goes from one brand to another. Especially is this true when comparing southern with northern irons. Unless you base your mixtures on the chemical composition of the iron, you cannot tell with certainty just what you are mixing.

Since no two furnaces produce the same grades of iron of the same composition, nor, in fact, does any furnace produce exactly the same composition in all its No. 1 pig-iron at every cast, doesn't it seem absurd for a foundryman to say that he always makes his mixtures 40-60? Suppose for instance he is using pig-iron with the chemical composition just right for ordinary machinery castings, for which, allowing for loss of silicon while melting, the mixture should contain 2.2% silicon before going into the cupola. If the scrap contains about 2% silicon, then to get that mixture the pig-iron would have to contain 2.5% silicon. Then 40% of this pig, and 60% of the scrap would give him 2.2% silicon in his mixture, although he would not be likely to know why his mixture was just right. But suppose the next carload of pig he receives is softer, say it contains 2.75%, 3%, or even 3.6% silicon, as these seem to be the prevailing percentages for southern irons, would the man that makes his mixtures by the 40-60 method, or by fracture, be able to tell the degrees of softness between them? He grades them all as pretty much alike, because the fracture does not vary much in appearance. Who can judge the exact composition of pig-iron cast in an iron casting-machine by its fracture?

Let us see how much good high-priced material the 40-60 men are throwing away every time they use pig that contains more than 2.5% silicon with ordinary machinery-scrap containing about 2% silicon, when they are making mixtures for the general run of machinery work. We will take the extreme figure quoted, namely, 3.6% silicon. To make the same mixture as we did with the 2.5% silicon pig, we would have to use only 12½% of the 3.6% pig, as against 40% of the 2.5%. How absurd it is for any foundryman to talk about 40-60 mixtures of iron! Such a man may have in his yard, or may be using an iron, if he only knew the real composition of it, by which he could make castings of the same composition with 27½% less pig than is required with the 2.5% pig-iron. It is the same with other mixtures. The saving reaches all down the line, no matter whether we are making semi-steel or soft iron for stove-plate. The man that mixes by analysis knows what to expect from his mixtures, simply because he knows what he puts into them. Yet some foundrymen think and maintain that there is nothing to be gained by mixing iron by analysis! The gain is not only in saving high-priced iron, but also in being able to mix and use up any low-grade material, or any old thing in the shape of iron and steel, and to make good castings from it. Not only that, but we can make two or more castings with practically the same analysis, even if we cast them on separate days.

Mixing by analysis does pay and pay well, and no one knows it better than the progressive foundryman, who makes it a point to learn all he can about his trade so as to help push it to the front. The foundry has been kept in the background too long, and the molders themselves are the ones to blame for it. As a class of mechanics they have always been content to put up with any old makeshift of shop or equipment. But thanks to a few really progressive men in the business, the foundry is being brought to an equality with any of the other mechanical trades, so that employers are beginning to realize that the

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foundry is just as important, and should be as fully equipped with labor-saving machinery as any other part of the plant. It behooves foundrymen everywhere to get and to introduce anything that will build up our trade, so that it will be shown the same respect and consideration as any other mechanical trade.

The automobile industry has been one of the biggest factors in bringing the foundry to its present standard. But, do you suppose for a moment that the foundry would have served the automobile industry as well if mixtures had been guessed instead of being determined by chemical analysis? Makers of automobile castings have to know what they are doing, so that they can make the same mixture, with the same chemical contents day after day. Only by scientific mixing have they brought the foundry to its present position in the automobile industry. But you can be assured they were not men who thought they could mix iron well enough on the 40-60 basis.

I have heard men criticize mixing iron by analysis, because, they say, "You can't tell the composition of the scrap." This criticism is made with particular frequency regarding large marine cylinders and other heavy castings, where large amounts of scrap must be used. Men who talk like that are not likely to know how hard or how soft they are making their cylinders, or any of their other castings. In making mixtures for large cylinders, the scrap need not be the controlling element in the mixture, so, if the foundryman should make a mistake of a point in judging the composition of the scrap, it would not influence the mixture to any great extent, especially not if the composition of the pig-iron is known, which it certainly should be when making mixtures for that class of work. All of the pig should be medium low-silicon, and especially low-phosphorus iron.

On the other hand, supose the pig-iron on hand is a little high in silicon, which would then make the scrap the controlling element. This would affect the mixture by having a larger proportion of scrap than pig-iron. Under such conditions, several pieces of selected scrap, for scrap for that class of work should be selected as far as possible, could be picked from different parts of the pile, a few drillings taken from each piece, and determinations made, which would then give practically the composition of the whole scrap-pile. Then the mixture could be figured almost exactly. Some of those who talk about the composition of scrap may be surprised to know that mixtures for large marine cylinders have been figured to give castings with 1.7% silicon, and the metal has contained that amount when determinations have been made. In making mixtures for cylinders we should always try to get from 5% to 15% steel scrap according to the section and weight of our castings.

Mixing by analysis is the only sure way to make mixtures, and it is the cheapest way. You know what you are doing, and you know what you are using with which to do it. It behooves anyone who has anything to do with making mixtures to learn all he can about this subject. Then, when he has mixtures to make to strict specifications, he will realize to his own satisfaction that it does pay to mix iron by chemical analysis.

Heating Drop-Forge Dies to Increase Their Life

In a recent issue of 'The American Drop-Forger', H. R. Reinhardt discusses a method patented by him for increasing the life of drop-forge dies by keeping them during use at a temperature considerably above atmospheric and somewhat below the hardening temperature of the die. In general, the temperature at which the tools or dies are to be kept during periods of active use, varies from 300° to 1100°F., depending on the characteristics of the steel, or alloy of which the die or tool is made. Dies of ordinary carbon-steel, containing from 0.75 to 0.90% carbon should be kept at a temperature of 400° to 500°F. For this material, the lighter the dropping-weight of the machine in which the die is used, or the lighter the stock of which the forging is to be produced, the lower the temperature at which the die should be kept. A high-speed tungsten-steel die containing, say, 16% tungsten, 3.4% chromium, 0.8% vanadium, and 0.65% carbon, should have a working-temperature of 1100°F. A steel containing 2% tungsten, 1% chromium, 0.80% silicon, and 0.45% carbon, which is much used for dies for hydraulic bulldozing and compression work, as well as hot-trimming and blanking, should have a working-temperature of 500°F. A die for hot-trimming, drop-forging, and hot or cold bolt-heading, made of steel containing 0.90% carbon, 0.40% manganese, 3.50% chromium, and 0.20% silicon should have a working-temperature of 750° Fahrenheit.

There are various ways by which this heating of the dies may be accomplished. The tool may be surrounded with a jacket packed with infusorial earth or with fine molding-sand, the whole apparatus being heated with gas-burners. Where the required temperature is relatively low, a bath of oil, lead, or lead-and-tin alloy may be used. By varying the proportions of lead and tin in the alloy, almost any melting-point between 400° and 600°F. may be obtained, thus furnishing a simple method of attaining and maintaining the proper temperature. There are also several forms of electric-heating apparatus that can be used.

DICKSON had been absent from his office for several days and on his return a friend insisted on knowing where he had been.

"Out to see a friend of mine who has a still," confessed Dickson.

"And did you sample his stuff?" the friend demanded.

"I guess I must have," he sighed, "there are two days I can't account for."—Los Angeles Times.

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INDUSTRIAL EQUIPMENT

SETTING UP PORTABLE WELDING EQUIPMENT

The following article is based on data appearing in 'Autogenous Welding', published by the Davis-Bournonville Co. While the information contained therein is especially applicable to work with the equipment manufactured by the company, nevertheless, it is of general value to the acetylene welder, no matter what kind of apparatus he uses.

Fig. 1 shows the Davis-Bournonville portable welding

Fig. 1. D-B Portable Welding Outfit

outfit, consisting of a large-wheel open truck carrying an acetylene and an oxygen cylinder, each chained to the frame of the truck, together with a tool-box at the rear, providing space for the torch, hose, tips, tools, and accessories. The cylinders are shown with the caps over the valves, as they are received from the service-stations. The operator is

Fig. 2. Cracking Cylinder Valves

dressed for welding, wearing cap, goggles, gloves, and overalls.

The cylinder-caps having been removed, Fig. 2 illustrates the next step in setting up a portable outfit, namely, 'cracking' the valve, the object being to loosen it, and to blow out dust that might have lodged in the nipple. The gas should be allowed to escape for an instant only. This procedure, which should be followed for both cylinders, should be done

Fig. 3. Attaching Pressure Regulators

Fig. 4. Connecting Hose to Regulators

Fig. 5. Opening Cylinder Valves

invariably with all new cylinders, just before attaching the regulators.

In Fig. 3, the operator is attaching the hose to the regulators, using a special wrench for tightening the nut. The regulator itself should never be used as a lever to tighten

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Fig. 6. Blowing Out the Hose

Fig. 7. Blowing Out the Torch

Fig. 8. Connecting the Hose to the Torch

the nut, as it may strain a joint in the connections and cause leaks.

In Fig. 4, the hose is shown, being connected to the regulator on the oxygen-cylinder. The procedure for the acetylene-cylinder is the same. Care must be taken in making all connections to see that they are free of oil, dust, or grease, and to tighten them with the wrench so that there will be no leakage of gas.

With the hose connected, the next operation, which is shown in Fig. 5, is opening the cylinder-valves with the adjusting screws of the regulator released. The pressure on

Fig. 9. Putting Tip in Torch

the acetylene-cylinder gauge should be about 250 lb., and on the oxygen gauge, 1800 pounds.

Blowing out the hose, the next operation, is illustrated in Fig. 6. This is done by turning the adjusting screws of the regulator just enough to permit the gas to blow through the hose with some force. Very little gas is required to blow all dust and other foreign substances from the hose, and the

Fig. 10. Adjusting Oxygen Pressure

valves can then be closed. Special care should be taken to avoid discharging a large quantity of acetylene, particularly in a small space.

Blowing out the torch, which is illustrated in Fig. 7, is the next operation. The torch needle-valves should first be opened, then the adjusting-screw for the oxygen-regulator turned, after which the oxygen-hose is inserted in the torch-head. A moment is sufficient to clean the interior of the torch, when the oxygen can be shut off by releasing the regulator-screw.

The next operation is connecting the hose-lengths to the torch, the acetylene-hose, which is red, to the lower nipple, and the black oxygen-hose to the upper nipple. Care should

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be taken to ensure clean connections and to avoid kinks in the hose. Tightening the nut is shown in Fig. 8.

Next the operator should insert the tip selected in the torch-head. The torch should be held in the left hand, with the mouth of the head up, and the tip, which must be clean, should be dropped into place. The nut is then tightened with the fingers as much as possible, following which the wrench is used as shown in Fig. 9. Only enough pressure should be exerted to make the joint gas-tight. Anything

Fig. 11. Adjusting Acetylene Pressure

more is not only unnecessary, but may cause injury to the nut and torch-head.

Adjusting the oxygen pressure, as shown in Fig. 10, is the next operation. The needle-valves in the torch are opened and the adjusting screw for the oxygen-regulator is

Fig. 12. Lighting the Acetylene

turned while the gas is escaping from the torch until the gauge indicates the desired pressure. The oxygen needle-valve is then closed, and a similar procedure followed, as illustrated in Fig. 11, to adjust the acetylene pressure.

With the acetylene flowing from the tip, the operator lights it with the spark-lighter, as shown in Fig. 12. Matches or any other open flame should not be used to light the acetylene. The flame should be directed downward.

The acetylene having been lighted, the operator should open the oxygen needle-valve, as shown in Fig. 13, and proceed to regulate it to secure a neutral flame. The white cone should be sharply defined, and, except for aluminum,

Fig. 13. Adjusting for Neutral Flame

Fig. 14. Welding Nipple to Pipe

Fig. 15. To Discover a Leak

the flame should indicate an excess of neither acetylene nor oxygen.

In Fig. 14, the operation of welding a nipple on a pipe is illustrated. The operator holds the torch in his right, and the welding-rod in his left hand. For convenience, the rod

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should be bent at a right angle six inches from the end. The heat of the puddle, and not the direct heat of the flame, should be the means of melting the rod.

If the welder detects the odor of acetylene, or has reason to believe that oxygen is leaking through one of the connections or through the hose, he should stop welding and test for leaks. A simple method to make this test is to shut the needle-valve in the torch, and the cylinder-valve on the suspected side, leaving the adjusting-screw for the regulator in, and then watch the hand of the working-pressure gauge, as shown in Fig. 15. If the pressure falls rapidly, there must be a leak.

Fig. 16. Using Soap-Suds to Find Leak

The position of such a leak may often be determined by holding the hose or the suspected connection close to the cheek. The escaping gas can be felt if the leak is considerable. Small leaks, however, can be detected only by the use of water or soapsuds. Fig. 16 shows the operator applying soap-suds with a small brush to the suspected place. If the leak is not discovered between the regulator and the torch, try the connection between the regulator and the cylinder-valve, and if unsuccessful there, apply the soapsuds to the regulator parts. Never use a match or other flame to find a leak.

DEVICES TO FACILITATE KEEPING TRACK OF WORK

To facilitate record-keeping in industrial plants, the Efficiency Devices Co., of Detroit, has developed various devices, some of which are shown in the accompanying illustrations. Fig. 1 and 2 show two different styles of planning-board, each, however, having its clips in groups of three, for jobs assigned, jobs in process, and jobs finished; or else jobs waiting, ready, and working. Tabs or tickets can be easily inserted and removed from the small holders. The ticket shows the job-number, machine, workman, and process.

To keep track of tools drawn from the toolroom, a combination of either board and a hand card-holder similar to the one shown in Fig. 3 but with different lettering, is used, or else a board with only one clip per number in place of three is substituted. A space on the board is assigned to each man and a space assigned to each kind or class of tool. Each man has a card-holder to carry his charge-slips. When a tool is drawn from the crib, a charge-slip is made in triplicate, one copy goes on the board in the space assigned to the workman, one goes in the space assigned to the tool, and one is placed by the workman in his carrier. The originals show the tool-keeper what tools are charged to any mechanic. The duplicates show where the tools are, and the triplicates show the workman and his foreman what tools are charged to him.

One manufacturer used a board similar to Fig. 1 in following work through the shop. Trouble had been experienced in getting all parts into the assembling department at

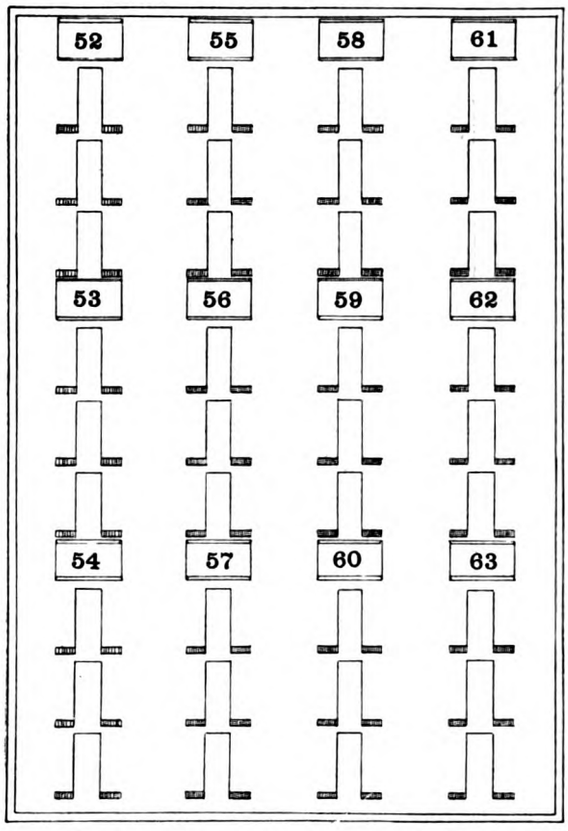

Fig. 1. Groups of Three Spring-Clips, With a Tab-Holder Over Each Group

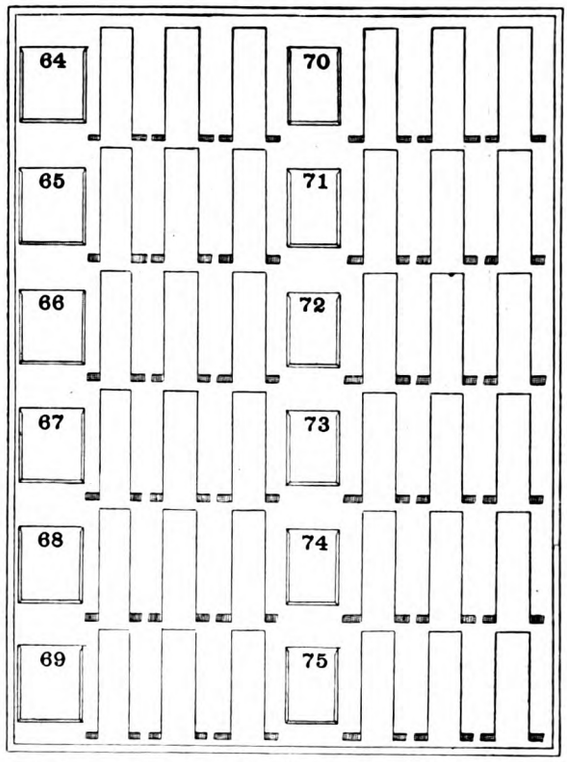

Fig. 2. Groups of Three Spring-Clips, With a Tab-Holder at the Side of Each Group

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the right time. Cards 1½ by 3 in. were printed in eight different colors, each order being given a different color. These cards show the name of the part, the blueprint number, the name of the completed machine, the shop-order number, the quantity ordered, and the various operations with a space for the date of each. All information except that regarding the operations is filled out before the cards are started. Each part is given a separate card, so that if a machine has 96 parts, there will be 96 tickets. The dates of the various operations, etc., are entered as the time-cards are received from the shop. In this way each part can be located at any time, from the pattern-shop to the assembling department. If a number of parts are seen to be

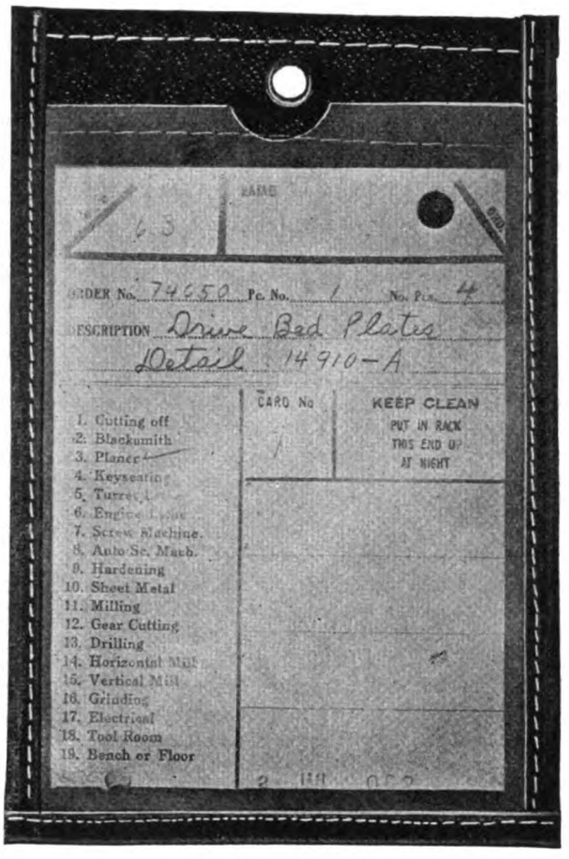


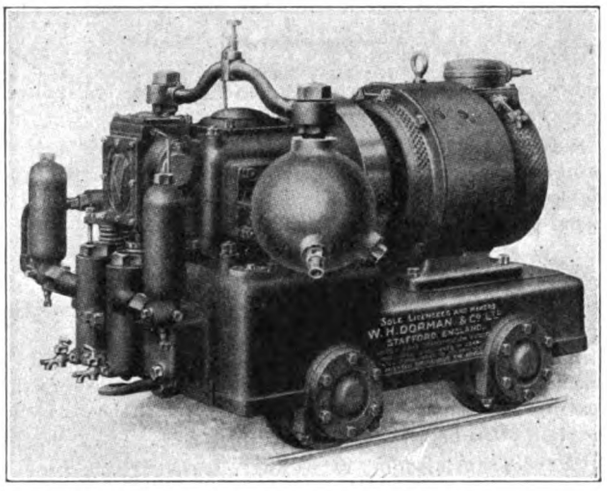
Fig. 3. Card Holder

in the machine-shop and another ticket shows no report at all, it is time to get after the foundry or the pattern-shop and have work on this part rushed. When all operations on any part are complete, and it is reported as being in the assembling room, the ticket is removed from the board. The first shop-order may be represented by red tickets, the next one by blue, and so forth. If all the red tickets have been removed except one or two, the remaining tickets show plainly where efforts are required. When the red tickets are removed, the white tickets behind them appear, showing that operations are under way on the second order. Each succeeding order is given a different color-card, and the cards placed one behind the other, so that each order follows the one just ahead. When the eight colors are used, they start over again, and since in this particular factory there are never more than eight orders on the same machine going through at the same time, there is no danger of a mistake. Another plant might find it advisable to have either a larger or a smaller number of colors, according to the extent of its operations and the character of the work. Each part is assigned its regular space on the planning-board, so that 'Gear R 38', for instance, can always be found readily.

'SONIC' TRANSMISSION OF POWER

There are at present five methods in commercial use for the transmission of power, namely, steam, direct mechanical, electric, compressed air, and hydraulic. 'Wave-transmission' and 'sonic transmission' are alternative names used to describe a sixth method in which are employed wave-motions or pulsations set up in an enclosed column of liquid. The liquid (usually water) is contained in a pipe connecting the apparatus generating the wave-motions to the machinery which applies them to useful work. Although apparently similar to hydraulic transmission, the underlying principle of 'wave-transmission' is totally and absolutely distinct. In hydraulics a continuous flow of liquid or motion of the liquid column as a whole invariably occurs, whereas in 'wave-transmission' there need be no direct or continuous flow, the particles of the liquid merely pulsating backward and forward about a mean position.

Water is compressible. Owing to the degree of its com-



Wave-Generator, Electrically Driven

pressibility being very small compared to many materials in daily use, the idea that water was incompressible came to be accepted even by engineers. For the first time in the history of mechanics advantage is taken in 'wave-transmission' of the elasticity of water (and also of oil and other fluids) to transmit energy.

What occurs in 'wave-transmission' can be illustrated by simple analogy. In the ordinary speaking-tube, pulsations set up in the contained air by the vibration of the speaker's vocal cords travel in the form of sound waves to the far end, where their energy is utilized in reproducing the vibrations in the ear of the listener. The column of air in the tube does not flow through the tube, but the particles merely subjected to small movements to and fro as the sound-waves pass along. Similarly in 'wave-power transmission' the pressure impulses set up by the wave-power generator travel through the column of fluid contained in a metal pipe which connects the wave-power generator to the wave-power motor. There is no continuous flow, the fluid progressively moves forward and backward about mean positions. The wave thus travels through the column of liquid and gives up its energy to the motor at the far end. The motor is a simple mechanism for converting the waves of energy into any desired mechanical action.

Taking the simplest form of 'wave-transmission', imagine two cylinders fitted with plungers, the cylinders on the underside of the plungers being connected together by a long pipe completely filled with water. If one of the plungers is moved rapidly up and down it will set up at each downward stroke waves of compressed water, which traveling along the pipe at the speed of sound (about 4800 ft. per second) will

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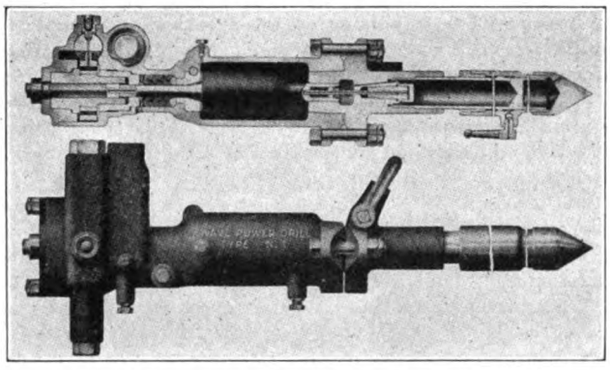
exert their energy on the plunger at the far end, and if this be suitably loaded, a simple reciprocating motion will be produced in exact synchronism with the reciprocations of the first plunger.

Wave-transmission equipments are inexpensive to manu-



Wave-Power Drill

facure, simple in construction, and practically 'fool-proof' in operation. They consist of:

Wave Generator: One or more metal cylinders each fitted with a piston connected by a crank-shaft to any type of high-speed prime mover such as an ordinary steam or internal-combustion engine or electric motor.

Wave Motor: One or more metal cylinders each fitted with a piston, designed to receive the power-wave at the intake end. The other end of the piston is suitably connected to the tool or other mechanism desired to be operated. The simplest application is found in such appliances as rock-drills and riveting-hammers in which the piston is used as a floating hammer and strikes directly on the shank-end of the drill-steel or rivet-snap.

'Wave-Transmission' Pipe-Line: Ordinary rigid or suitable flexible piping is used to contain the liquid which extends from the wave generator to the motor, and is referred to as 'the liquid column'. Various kinds of fluid may be used, from water to heavy oil. The highest transmission efficiency is, however, obtained through water.

In many ways electricity offers an excellent analogy to explain both 'wave-transmission' and hydraulics, ordinary hydraulics being represented by the continuous current and 'wave-transmission' by the alternating current systems. From the scientific and practical point of view one of the most interesting facts about 'wave-transmission' is this similarity in many features to alternating-current electrical transmission. The points of resemblance are not mere coincidences. They go to prove the important fact that this purely physical method of transmitting energy is closely allied and is for all practical purposes a sister method, to the alternating-current electrical system. Anyone with a knowledge of electricity will find it easy to understand 'wave-transmission'. The laws and formulae of wave and of electrical transmission coincide to the extent that they are nearly interchangeable. Most of the phenomena of electricity have their parallel in 'wave-transmission'. For instance there are direct equivalents for volts, amperes, frequencies, angle of phase, induction, capacity, resistance, condensers, transformers, and single-phase or poly-phase systems. In both systems there are used generators, rotary and reciprocating motors, and transmission lines.

G. Constantinesco is the inventor and W. H. Dorman & Co., Ltd., Stafford, England, is manufacturing a complete line of tools to take the place of compressed-air systems. The Dorman company claims simplicity, portability, low initial cost, and safety as leading features of their equipment and estimate the comparative efficiency as follows:

	Compressed air	Wave-power transmission
Mechanical efficiency over all	10%	50%
Cost of maintenance per annum in proportion to the original cost of tools	100%	33%
Capital cost of plant, including prime mover	100%	50%
Power required to be put into the system to procure 1 hp. at the working-face	10 hp.	2 hp.

This method of transmission was used during the War for 'C. C. gears' for automatic firing of aeroplane guns and more than 30,000 equipments were made. Generators are constructed in sizes from 10 hp. up and for frequencies up to 50 cycles per second.

RADIUM, A NEW ELEMENT IN THE SAFETY MOVEMENT

Radium has now been linked with the safety movement and will lend its power to the prevention of accidents. Many causes of accidents in factories, in mines, and in other industrial institutions, where darkness is a creator of danger, are being eliminated by means of radium-luminous material. Radium watches are familiar articles. The same material that illuminates these is now being employed in factories on power-line switches, where fumbling might mean electrocution to the operator. High-pressure gauges are deprived of a great deal of their safety value through inconstant lighting. Their dependability as indicators is increased by making them luminous 24 hours a day through the application of radium-luminous material.

Electric switches are often set in places that are not illuminated, particularly for lighting equipment, where they are usually visible only after the lights they control have been turned on. A spot of radium-luminous material on the switch makes the latter easy to find in the dark, so that dangerous delay emergencies may be avoided.

Similarly, the value of a fire-alarm signal or a fire-extinguisher is considerably reduced if invisible in the dark. Telephones often need to be found quickly in the dark in emergencies and various emergency call-bells are made more useful through the application of luminous material. The need of luminous poison-bottles, which will stand out warningly in the dark, has often been demonstrated. Bolts that must be attached to the dark under-portions of machines and equipment may be touched with luminous material and a saving of bloodshed be accomplished.

The value of radium to mariners is commencing to be recognized. Not only the compass-dials, but the steering-wheels, gauges, and other instruments which should be instantly and uninterruptedly visible, have been touched with radium. Motorists, motorcyclists, and the operators of any machinery with indicating-dials or with gauges that tell the speed of the motor or the quantity and mixture of fuels and oils, are finding the solution of their difficulties in radium-luminous material.

In addition to the use of radium-luminous material on machinery in industrial plants, it is used extensively for marking any corner or spot that should be visible in the dark. The efficiency of even the electric torch is increased when it has a touch of radium so that it can be reached instantly in an emergency in the dark. When other lights fail, when fuses blow out, or wires break down, radium will glow dependably without danger of explosion or of burning.

The new brass-foundry at the Southern Pacific shops at Sacramento has been completed and is now in operation, and the new spring-shop is nearly finished. Work has been started on a frame and corrugated iron general-store building, two stories high and 700 ft. long. The estimated cost is $220,000. A new planing-mill, 126 by 360 ft. and costing $197,000, is under construction. Plans are being prepared for a car-wheel shop, a gray-iron foundry, and a pattern-storage building.

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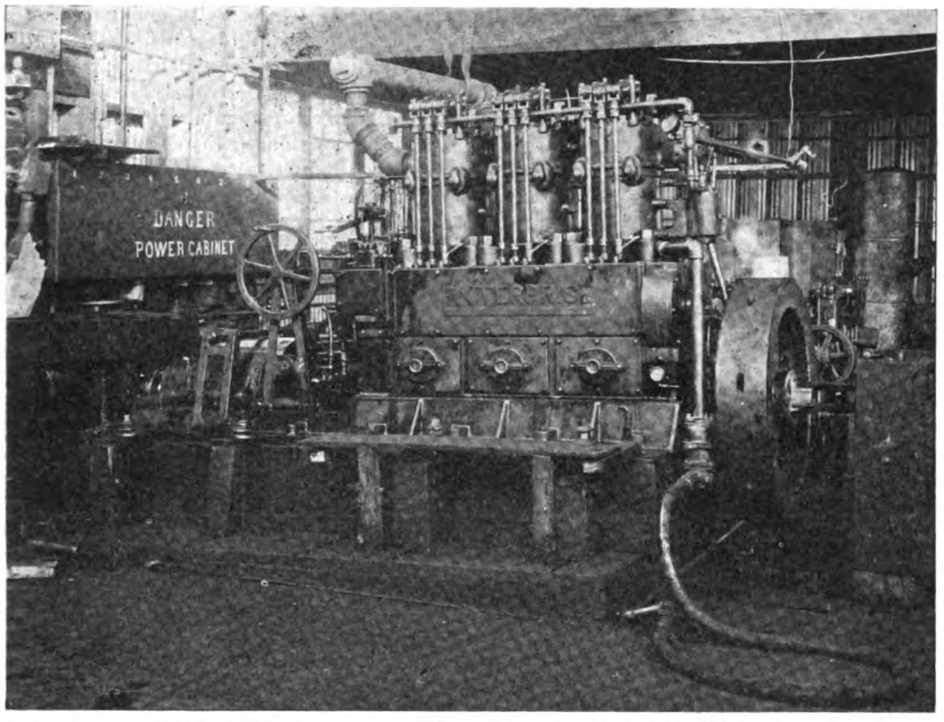
THE FIRST DIESEL ENGINE TO BE BUILT IN SAN FRANCISCO

The Enterprise Foundry Co. has acquired the Western rights in certain Diesel engine patents, modifying the design somewhat to suit special conditions, and is now manufacturing engines at its Potrero plant at 18th and Alabama streets. One of these has been completed, and after a complete series of tests, will be shipped to the company's Seattle agency.

The engine is a four-cycle full-Diesel marine engine with solid injection. There are three cylinders, 9¼-in. bore by 14-in. stroke. The egine is rated at 80 hp. at 320 r.p.m., but has developed during the tests as much as 92.8 hp. over a considerable length of run. The maximum pressure is about 500 lb. Fuel-oil of about 15° gravity is used, and the consumption per horse-power hour at full load is about ½ lb. The fuel-tank and feed-line are arranged so that the exhaust heats the oil.



Enterprise Diesel Engine on Testing-Block

The oil is supplied to the cylinders by three small direct-acting pumps, one for each cylinder, no injection-air being used. There is a small compressor to supply air for starting and for a whistle. The amount of fuel injected by each pump, and consequently the speed of the engine, is regulated by a quadrant-lever controlling the length of the pumps.

There are three cams on each cylinders. The after-cam controls the air on the intake-stroke, the centre-cam is for the starting-air, and the forward-cam is for the exhaust. A device on the centre-cam valves provides for cutting off the starting-air as soon as combustion takes place. A small force-pump on the forward end of the engine, working at about 12 lb. pressure, operates the main lubricating system.

All work on the engine, from the castings up, was done by the Enterprise Foundry Co. and its affiliated concern, the Enterprise Gas Engine Co. The completed engine weighs between eight and nine tons. Other engines of the same type are now in process of manufacture. The intention is to construct a line of one, two, three, four, six, and eight-cylinder engines, all with the same size cylinders as the one just completed.

INDUSTRIAL RELATIONS ASSOCIATION HEARS B. M. RASTALL

The regular monthly meeting of the Industrial Relations Association of California, formerly the Service and Employment Managers' Association, was held at the Commercial Club, San Francisco, Saturday evening, November 20. About 50 members and guests were present. In the business meeting, progress was reported by the secretary, C. L. Foster, in the preparation of a standard form for a 'Labor Interchange Report', showing men about to be laid off, positions open, etc., which would be filled out by the various members of the Association. This would in effect enable the Association to maintain the same kind of labor clearing house among all companies whose employment managers were members of the Association as a well-organized employment department does between the various departments of a single company, and would frequently give a company obliged to lay off a capable workman the opportunity to pass him on to another concern taking on men.

The address of the evening, on 'Handling Men' was delivered by B. M. Rastall, industrial consultant of New York, at present engaged in research work for the San Francisco Chamber of Commerce. Mr. Rastall called attention to the fact that the success of any industrial organization is dependent upon efficiency of materials, processes, and service, and that, while perfection in any two departments is not sufficient if the third is lacking, efficiency of service is the most important of the three. High-grade production is therefore dependent on efficiency of service, which can be obtained by having good men, good conditions, and an adequate incentive.

The first essential for the employment department in getting good men is to try to keep from hiring poor ones. Here an analogy with the life insurance field is helpful. The insurance agent does not go down the street buttonholing each man he meets and expatiating on his need of insurance. On the contrary, he calls on a selected list of prospects, men concerning whom he knows the principal facts bearing on the case before he even tries to see them. In general the chance of the employment department's obtaining good men varies directly with its breadth of contact with the world in general. An illustration of how this breadth of contact may be increased is found in the recent movement by the National Retail Dry Goods Association to promote the study of salesmanship in the high-schools. This is being done not so much with the idea that the individuals taking these courses will develop into better salesmen and women than those that do not, but rather because records have shown definitely that girls with a high-school education make better saleswomen than girls with only a common-school education. By starting such classes in salesmanship, this preferred class of girls will be more likely to take up that kind of work and the stores will ultimately benefit thereby. Turning from methods of increasing breadth of contact, Mr. Rastall mentioned various methods of selection of applicants, and laid particular stress upon the importance of having applicants interviewed by two or more

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persons, preferably foremen or department heads directly concerned as well as members of the employment department.

Under good conditions, the importance of the physical environment of the working-hours was emphasized. During the war period, it was estimated that noise alone decreased the efficiency of clerical workers in some of the Government buildings at least 25%. A factor that is frequently overlooked is the humidity of the air. Too much humidity produces lethargy, too little, nervous irritability. An investigation made by several New York department stores indicated that much of the irritability of both shoppers and clerks during the Christmas rush was due to the dryness of the air of the furnace-heated buildings. Consequently the store-owners have considered it good business to spend large amounts on the installation of humidifiers.

Working conditions during the eight hours, more or less, that a man is at work, are, however, only part of the problem. Whether a plant is in a large city or in a one-industry town, the employment department should be concerned with the living conditions that surround the worker during the other hours of the twenty-hour, not in an officious paternal way, but in a generally helpful one. Mr. Rastall instanced the particular case of a company operating in a small Wisconsin town because of nearness to raw material that felt justified in expending not only money but also the time of its officials working on public boards in order to obtain living conditions in the town such as to attract the best workmen.

No general rule can be laid down regarding bonus or profit-sharing systems or other schemes for making a man's compensation depend upon his efficiency, but all these should be studied. The immediate money reward is, however, not the only thing to be considered in providing an adequate incentive. There is also the 'open door ahead'. Some of the ways to provide this are found in the development of the understudy system, in refusing to import men from the outside to fill the higher positions unless it is necessary, in arranging the duties of the various grades of positions so that as far as possible one grade will train for, and lead to, the next higher rank, and in various direct educational plans. Among these latter, the efforts of the American Institute of Banking to bridge the gap between the clerical and the executive positions in banking deserve special mention.

The most careful development of these incentives, however, will not eliminate the need for the old incentive of appreciation, patting a man on the back, figuratively or literally, when he has done good work. In this connection, it should be emphasized that the modern organization of industry has not eliminated the personal element, frequent statements to the contrary notwithstanding. It is true that some industrial establishments have become so large that the manager cannot know each individual workman, but that does not prevent personal contact being made throughout the plant, particularly by means of the employment department.

Messrs. Bell, Kelly, Cross, Lombard, Foster, Burr, and Wahlberg took part in the discussion, which was closed by Mr. Rastall in a review of the principal points brought out.

The officers of the Association are: M. C. Burr, president; J. F. Johnston, vice-president; C. L. Foster, secretary and treasurer, and Ira B. Cross, consulting economist. The office of the Association is at 93 Bacon Bdg., Oakland.

THE INDUSTRIAL COST ASSOCIATION

Realizing the importance of knowledge and control of costs, a number of American manufacturers have formed the Industrial Cost Association. The objects of the Association are given as follows in a pamphlet issued from its executive offices, People's Bank Bdg., Pittsburgh:

1. To stimulate the interest of all manufacturers in correctly determined costs.

2. To standardize cost and accounting terminology; to establish governing principles; and to simplify cost accounting.

3. To educate members in the use and advantage of graphic charts and other modern methods of cost analysis and control.

4. To assist members of the Association that are identified with cost committees of trade organizations in formulating uniform cost methods, and to recommend to members the adoption of such uniform methods.

5. To provide a forum for the discussion of cost problems and practices through general and local meetings; and to gather and disseminate news of interest to members.

6. To establish a library of cost literature, and to maintain a bureau of information through which members may be assisted in the solution of their individual cost problems.

7. To co-ordinate the efforts of members to the end that cost of production may be considered in its proper relation to the complex problems of industrial management.

Active membership in the Association is limited to officers and managers of industrial corporations, firms, and trade associations, and to employees having executive supervision of their cost accounting. Associate membership is extended to bankers, engineers, and others whom the directors may wish to have affiliated with the Association in an advisory capacity. Membership dues are $25 per year. No fees or assessments of any kind will be charged members for service rendered by the Association.

The officers of the Association are M. F. Simmons, of the General Electric Co., president; C. H. Smith, of the Westinghouse Air Brake Co., first vice-president; and R. H. Zinn, of the Tanners' Council of New York, second vice-president. Correspondence, including applications for membership, should be addressed to the secretary and treasurer, A. A. Alles, at the executive offices of the Association, Peoples Bank Bdg., Pittsburgh. Additional information regarding the Association may be obtained from the secretary, from W. A. Scott, 307 Flood Bdg., San Francisco, or at the office of 'Metal Trades'.

CALIFORNIA INDUSTRIAL ACCIDENT COMMISSION PREPARING SAFETY ORDERS FOR SHIPBUILDING

For several months past, two committees, one at San Francisco and one at Los Angeles, have, at the instance of the California Industrial Accident Commission, been preparing Tentative Shipbuilding Safety Orders. The San Francisco committee has 21 members, the chairman being W. L. Denton, safety engineer for the Union Construction Co. W. T. Corbusier, safety engineer for the Southwestern Shipbuilding Co., is chairman of the Los Angeles committee, which has 8 members. L. Dee Miller, engineer for the shipyard division of the safety department of the Commission, has acted as secretary for both committees. The membership of the committees includes the safety engineers from the principal yards, as well as some department heads, labor-union officials, and others interested.

The tentative orders prepared by the committees have been printed in pamphlet form and may be obtained by those interested upon application to the Commission. Public hearings were held by the Commission at Los Angeles on November 16 and in San Francisco on November 23, each order being subjected to close scrutiny. There was much discussion and some difference of opinion, but no difference in the desire on the part of all concerned to do everything in reason to prevent accidents. The permanent orders will be issued as soon as is feasible. No date has been set as yet for the orders to go into effect, but it is understood that the time will be set so as to give ample leeway to the yards to make the changes in their equipment

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necessary to conform with the orders. The orders will apply "to the re-conditioning, rebuilding, altering, overhauling, and repairing of all ships or boats irrespective of type or description, as well as all types of ships or boats under construction (exception, row-boats, racing-shells, and life-boats) in the State of California; provided that in cases where, in the opinion of the Industrial Accident Commission, the enforcement of any order would not materially increase the safety of employees, and would work undue hardship on the employer, exemptions may be made at the discretion of said Commission, but such exemptions must be in writing to be effective, and can be revoked after reasonable notice is given in writing".

BUY CHRISTMAS SEALS

From November 25 until Christmas Eve, the health and happiness of many thousands in California will rest in the balance. This is the time of the year when the California Tuberculosis Association through its local branches and hundreds of unselfish supporters places on sale the little Christmas Seals, the proceeds of which supply funds for the battle against the white plague. Every letter or package mailed in California during this period, that bears one of the

little Christmas Seals inclines the balance on the side of health and happiness and gives each and every user of the little seal the thrill of having contributed his 'bit' toward making California and the country at large a better place in which to live.

Interest in this great work varies. The average individual buys his quota of seals knowing that he is contributing within his means the funds necessary to carry on a work that is as essential to the well-being of the commonwealth as the orderly working of legislative machinery. But the person thoroughly familiar with the work, goes a step further. He invests in the Tuberculosis Association health bond the coupons of which are collected in improved community health and renewed activity against the greatest foe of the white race, tuberculosis. Theodore Roosevelt once remarked "The only persons who do not invest in and use Christmas seals are the ignorant or the destitute."

Stripped of all verbiage, the purchase of a Christmas seal is a vote to give sunshine, fresh air, and decent food to those that need it most, those that have been attacked by the dread disease, whether they be children or adults.

God never intended sunshine and fresh air for the few, yet there are some that are being deprived of it and the person that does not buy his quota is a party to the act, usually unknowingly. A brief glance at the work done during the past year, without solicited subscriptions and supported through the sale of seals and bonds, is a revelation of human service.

Sanatoriums have been maintained for the tuberculous in 26 counties with some assistance from the State. Nurses have been maintained in 18 counties by the local associations and in counties having no nurse, the State Association sends its traveling rural nurse. In three counties open-air schools have been instituted for children of frail constitution. Clinics are supported in nine counties by the sale of seals, and, in each, a camp has been established where children needing outdoor life, good food, and care to build them up, are sent during the vacation period. In counties where no clinic is held, the State Association sends its motor clinic with full hospital equipment, nurse, physician, and driver to carry the message of better health. The State Association maintains a Sunshine Preventorium for children too ill to be sent to a camp and like institutions are maintained in three counties by local associations. Three Occupational Therapy teachers are aiding tuberculosis patients to become self-supporting by teaching light trades. A modern health-crusade director has enrolled 100,000 school children in the State personal hygiene campaign which means better health in future years. Education and health are companions and the State Association has distributed 1,000,000 pieces of literature in the campaign to teach the tenets of better health.

This in brief is the accomplishment of the money which is invested in the Christmas seals and health bonds. Next year is a crucial period in the history of progress toward better health. Influenza, war, food scarcity, and other causes make an imposing barricade to the steady progress of the fight against tuberculosis. A dollar's worth of seals or a health bond may save someone from the human junk-pile, or it may bring a ray of sunshine into a little child's life. In what better way could "Peace on earth, good will to all" be expressed?

Trade Notes

The Samson Tractor Co. has opened its new sales and service building on South Figueroa street, Los Angeles.

The General Electric Co. has issued bulletin No. 40017-A, 'Small Direct-Current Generators and Exciters, Type ML'.

The Michigan-California Lumber Co. is making surveys for about 40 miles of logging railroad in El Dorado county.

The Federal Telegraph Co. will construct a wireless station at Port Sunnyvale at the southern end of San Francisco bay.

The Beaver Board Companies will build a factory at Los Angeles. The estimated cost is $500,000, not including equipment.

The name of the **California Die Casting Co.**, of 881 33rd street, Oakland, has been changed to the **Coast Die Casting Corporation.**

The West Coast Rubber Corporation has opened a factory on Dolores street, San Francisco, for the manufacture of automobile tires.

A special meeting of the **Main Iron Works** will be held on January 17 to consider a proposed increase of the capital stock of the company.

The Fidelity Trust & Savings Bank, of Fresno, will erect a 15-story office-building at J and Mariposa streets. The estimated cost is $1,000,000.

Warren Howell and **Gardner Sherburne**, of Pasaden have organized the **Standard Machine & Auto Works** manufacture automobile parts.

The pattern-shop of the **Vulcan Manufacturing Co.**, of Seattle, was badly damaged and a number of patterns destroyed by fire on November 12.

A. P. Gilles is promoting the **United States Electric Steel Products Co.**, which has been organized to construct electric-steel furnaces and rolling-mills at Sacramento.

The Vegetable Oil Products Co., of Seattle, has been or-

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ganized to construct a vegetal-oil plant at that city and is offering $300,000 worth of common stock to the public.

The Bear Chain Co., representing the **Bear Manufacturing Co.**, of Rock Island, Illinois, has opened a factory branch at 948 Market street, San Francisco, in charge of W. T. Aplas.

The Hutchinson Lumber Co. will start construction in March of a sawmill, planing-mill, and box-factory at Oroville. The mill will have an output of 400,000 ft. of lumber per day.

The Readymade Sign Co., of New York, has issued a new catalogue showing a few of the 2000 different enameled-steel signs, most of them for factory use, that the company carries in stock.

The Sacovalley Meat Canning & Provision Co. will commence early in December the construction of the first unit of its packing-plant near Sacramento. The estimated cost is $200,000.

W. S. Quigley, president of the Quigley Furnace Specialties Co., of New York, has returned from Europe after supervising the installation of several powdered-coal systems in Italy and Belgium.

The Philadelphia 'Public Ledger' recently published in its pictorial section, a number of interesting photographs of the South Philadelphia Works of the **Westinghouse Electric & Manufacturing Company.**

J. Waldo Smith, chief engineer for the Board of Water Supply of the city of New York, addressed the members of the San Francisco Engineers' Club on December 1 on the water-supply of that city.

The Downs-Osborne Co. will erect a factory-building at Sedro Woolley, Washington, for manufacturing tractors. Castings are being made for the company by the **Skagit Steel & Iron Works** of that city.

The Sims & Gray Iron Works, 156 Main street, San Francisco, has outgrown its present plant and is erecting a one-story shop-building on Bryant near Third street, which will be ready for occupancy early in January.

The War Department has authorized the construction of a drawbridge across the Sacramento river at Isleton, and the Board of Supervisors of Sacramento county is expected to proceed with this work in the near future.

Jacuzzi Bros., Inc., of Berkeley, doing a general garage and aeroplane business, has been authorized to issue 61,565 shares of stock to acquire the business of **Jacuzzi Bros.**, a partnership, and to sell 38,435 shares, par value $1.

The American Society of Mechanical Engineers announces that a limited number of copies of its 'Condensed Catalogues', hitherto distributed to members of the Society only, will this year be available for sale to the general public.

The A. & F. Brown Co., of Elizabethport, New Jersey, has issued catalogue No. 66 describing the power-transmission machinery, including pulleys, hangers, couplings, sheaves, gears, and pillow-blocks, manufactured by the company.

The Los Angeles Steel Ball Co., of Los Angeles, has been incorporated with a capital stock of $200,000 to manufacture ball-bearings and other steel specialties. J. T. Kerr, F. N. Hobbs, and G. D. Meiklejohn are the incorporators.

The Triple Drive Tractor & Plow Co., of Riverside, has been incorporated to manufacture agricultural machinery by C. W. Kirby, N. B. Last, R. H. Humphreys, and C. W. Renshoof, of Riverside, and R. N. Halsey of San Bernardino.

The Magnesia Products Co., formerly the Mineral Products Co., of Patterson, Stanislaus county, will spend $100,000 in doubling the capacity of its plant. The present output is about 160,000 lb. of insulating products per month.

The Commercial Brass Foundry, 550 Fourth street, San Francisco, has purchased a Schwartz furnace, which will enable it to handle single castings weighing more than 2000 lb. A traveling crane is also to be installed in the near future.

The Modern Pattern Works, 221 Washington street, Oakland, announces the establishment of a metal-pattern department in charge of an experienced metal-pattern maker, thoroughly acquainted with molding-machine practice in the foundry.

The building at 123-131 Beale street, San Francisco, occupied by the **San Francisco Welding & Brazing Works** and the **California Machine Co.** was destroyed by fire recently. The estimated loss, including damage to machinery, is $75,000.

The Balaklala Copper Co. has completed the wrecking of its $1,000,000 copper-smelter at Coram, Shasta county. The steel from the smelter is being used in the construction of the reduction works of the **Shasta Zinc & Copper Co.** at Bully Hill.

The Harris Manufacturing Co., of Stockton, has decided to make its Walla Walla, Washington, branch the distributing centre for its machinery for the North-West. A stock of between $400,000 and $500,000 worth of machinery will be maintained.

Through a misunderstanding, the new brass-foundry at the Southern Pacific shops at Sacramento was noted on page 520 of this issue as being in operation. The building itself has been finished but the installation of equipment has not been completed.

With the advice, "Buy what you need, not what you want, but if you need it, buy it", comes an announcement to the trade from **Smith-Booth-Usher Co.**, of a readiness to follow the market, and a guarantee of prices against decline up to February 1, 1921.

Contract for re-conditioning the **Matson Navigation Co.'s** steamer 'Enterprise' has been awarded to the **Moore Shipbuilding Co.**, the lowest bidder, for $186,000. There were five other bidders, the amounts named ranging from $193,578.95 to $275,000.

Contract for the construction of a filtration plant for the municipal water system of Sacramento has been awarded to the **Coast Construction Co.**, of San Francisco, on a cost-plus basis, which, it is estimated, will make the actual cost to the city about $1,000,000.

Erle M. Leaf has been appointed first vice-president and assistant treasurer of the Los Angeles Shipbuilding & Drydock Co. Mr. Leaf has been secretary of the company since its organization, and will continue to act in that capacity in addition to his new duties.

The M. J. Ryan Co. has commenced operations at its new $75,000 factory at Van Ness and Railroad avenues, Fresno. The company manufactures the Wilson packless centrifugal pump for farm pumping-plants. The plant includes both foundry and machine-shop.

The directors of **California Tractors, Inc.**, manufacturing the 'Bear' line of tractors, are considering the establishment of a $500,000 factory at Fresno. W. F. Dunn is president, A. R. Hathaway, vice-president and general manager, and L. O. Stephens, of Fresno, is secretary.

The Pacific Car Building Co., which was formed to take over the car and automobile-body business of A. Meister & Sons, of Sacramento, and which has been building a plant at Woodland, is trying to raise $30,000 to pay outstanding debts and permit it to continue business.

According to a statement recently issued by the **Pangborn Corporation**, of Hagerstown, Maryland, its sales of sand-blast equipment in 1920 were 800% greater than its sales in 1914. These figures, it is believed, are typical of the growth in the use of sand-blast equipment in general.

The Hanna Engineering Works, of Chicago, manufacturer and distributor for the **Mumford Molding Machine Co.**, has issued Catalogue No. 10 describing the Mumford molding-machines. These machines are of both the plain squeeze and the jolt-squeeze type, and are built in several sizes.

The Electric Furnace Construction Co., of Philadelphia, has issued a reprint of a paper presented by Frank W.

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Brooke and G. P. Mills before the Philadelphia Section of the Association of Iron and Steel Electrical Engineers on 'Electric v. Combustion Furnaces for Heat Treating and Annealing'.

The Excelsior Brass Works, 1168 Bryant street, San Francisco, has been incorporated. The company manufactures and deals in machinery, besides doing a general machine-shop business. Additional property is to be purchased and the plant extended to accommodate the increased business of the company.

H. B. Griffin, vice-president of the **Doehler Die Casting Co.,** visited San Francisco during November, in company with **F. C. Seeger,** sales engineer for the company. Mr. Seeger will have charge of the Pacific Coast sales office of the company, which is to be established in San Francisco, the exact location of which had not been determined at the time of going to press. Mr. Seeger's temporary address is 302 Breed avenue, San Leandro.

The United American Lines, Inc., operating the fleet of the American-Hawaiian Steamship Co. in the old coast-to-coast service of that company, is considering the equipment of the holds of several of its vessels with refrigerating apparatus in order to permit it carrying fresh fruit and other products from the Pacific to the Atlantic Coast in competition with the railroads.

Incorporation of **Coast Range Steel, Ltd.,** at Vancouver, British Columbia, with a capital stock of $15,000,000, is announced. The company will build iron and steel plants in British Columbia, and it is stated that the Government will pay a bounty of $3 per ton of pig-iron produced. The directors are H. J. Landahl, F. T. Congdon, J. D. Kearns, J. S. Teta, and Montague Moore.

The Vulcan Manufacturing Co., of Seattle, has sold the structural-steel part of its business, including its main building devoted to fabrication and storing structural steel, to the **Barde Industrial Corporation,** of Portland and New York, the concern that bought most of the surplus equipment held by the U. S. Shipping Board. The Vulcan company will continue the other departments of its business.

The Union Construction Co., of Oakland, is sending to the home address of each one of its employees an attractively printed Thanksgiving greeting calling attention to the general causes for Thanksgiving and to the particular reason for both the company and its employees to be thankful, namely, the conclusion of one year of continuous employment under good conditions and at good wages.

Rear-Admiral W. S. Benson has been re-appointed chairman of the U. S. Shipping Board, his term being six years. The other six appointees and their terms are as follows: **Frederick I. Thompson,** of Alabama, five years; **Joseph N. Teal,** of Oregon, four years; **John A. Donald,** New York, three years; **Chester H. Rowell,** California, two years; **Guy D. Goff,** Wisconsin, one year; and **Charles Sutter,** Missouri, one year.

The Better America Federation has elected the following officers for the coming year: president, H. M. Haldeman, Los Angeles; vice-presidents, Eli Weil, San Francisco; Reese Llewellyn, Los Angeles; and F. D. Prescott, Fresno; treasurer, L. V. Starr, Los Angeles; managing director, Woodworth Clum, Los Angeles; directors, F. B. McDevitt, Sacramento; J. W. Carthwaite, Oakland; Marck C. Myers, Orange; and A. B. C. Dohrmann, San Francisco.

The Bushnell Manufacturing Co., of Berkeley, formerly the **Bushnell Machine Works,** has been authorized to issue 2700 shares of stock to John B. and Edith Bushnell in exchange for the business and assets of the Bushnell Machine Works, and to sell 2000 shares of a par value of $10 to net the company $8.50 per share. The proceeds of the sale of stock are to be used in increasing the company's manufacturing facilities and extending its business.

The Simplex Ice Machine Co. has opened a factory at 230 Eighth street, San Francisco, and will manufacture small ice-machines, the capacity ranging from 350 to 3000 lb. per day. The company was originally established at Fort Worth, Texas, but decided to move its plant to San Francisco. The plant has an area of 12,000 sq. ft. and will employ 50 men. The officers of the company are Edward J. Warnecke, president; H. E. Moore, vice-president and manager; and J. Young, secretary.

J. A. Kinkead and **C. W. Hunt, Jr.,** announce the opening of the offices of the **Engineering Products Co.** in the Rialto Bdg., San Francisco. The company is Pacific Coast agent for the Penn Iron & Steel Co., Falls Hollow Staybolt Co., J. Faissler Manufacturing Co., Lovekin Pipe Expanding & Flanging Co., Hunter Saw & Machine Co., Seminole Chemical Co., Inc., William V. Dee Co., Hobbs Chain Co., and Key Boiler Equipment Company.

The Pacific Enameling & Manufacturing Co., of Oakland, has been authorized to issue 70 shares of stock to J. R. Watson and R. B. Watson in exchange for various secret formulas and processes for making enamelware, together with various plans, designs, and contracts, and to sell 205 shares of stock of a par value of $100 to net the company $80 per share. A factory on 60th street, Oakland, is to be equipped for the manufacture of enamelware.

Most of the other large independent steel producers have followed the lead of the **Jones & Laughlin Steel Co.,** and have reduced their prices on the principal finished products to the figures established by the so-called 'price stabilizing board' in March 1919. The U. S. Steel Corporation has quoted these prices ever since they were originally fixed, but because of the long delays in making deliveries, this fact has, until now, had little effect upon actual market conditions.

The name of the **C. L. Best Gas Traction Co.** has been changed to the **C. L. Best Tractor Co.** The company's statement as of September 30, 1920, shows total assets of $2,715,820 and a surplus, subject to provision for Federal taxes, of $827,258. The net earnings during the nine months ended September 30 were $533,450 before deductions for Federal taxes. Manufacture of the new 30-hp. tractor in addition to the present 60-hp. model will commence about January 1.

The Alaska Coke & Coal Co., of Portland, has leased the old Cunningham mine near Controller bay, Alaska, and will commence operating the mine early in 1921. The mine produces a semi-bituminous coking coal that is practically smokeless. An output of 500 tons per day is expected at first, which will later be increased. To transport the product the Alaska Anthracite railroad will be extended to the mine, a dock will be built on Controller bay, and a line of steamers will be established.

Fairbanks, Morse & Co. has purchased the entire business consisting of all stock on hand, good-will, and liabilities of the Luster Machine Shop & Railway Equipment Co. of Philadelphia. Fairbanks-Morse has opened a new branch at this address under the management of D. W. Dunn, and will sell its complete line of engines, motors, pumps, etc. The entire personnel of the Luster Machinery Co. has been retained. E. J. Luster, former president, will be manager of the machine-tool division of the Fairbanks-Morse Philadelphia branch.

Surplus material on the Pacific Coast belonging to the U. S. Shipping Board has been sold to **Barde Bros., Inc.,** of New York. The terms of sale provide that the Board is guaranteed 50% of the appraised value of materials, which must be sold by Barde Bros. west of the Rocky Mountains within one year. Barde Bros. are to receive returns in excess of the appraised value up to 60%, and all returns above 60% are to be divided, 75% to the Board and 25% to Barde Bros. The total appraised value of the material is about $15,000,000.

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The employees at the Stockton plant of the **Holt Manufacturing Co.** staged their third 'Safety First' show at the T. & D. theatre in that city on November 23. The program included a 'Safety First' address by J. S. Thomas, a minstrel show directed by the 'Caterpillar' Glee Club, two short comedies, and a number of other vaudeville 'stunts' of various kinds. The committee in charge was composed of W. E. Spencer, chairman, Ella Crisholm, G. T. Arthur, J. M. Bond, H. G. Holderman, E. W. Cummings, G. F. Schmelzel, A. G. Lillybridge, H. W. Perkins, and Carl Tremain.

The Electric Furnace Co., Alliance, Ohio, is installing a completely automatic heat-treating set at the new plant of the C. H. Willys Co., of Marysville, Michigan. The set is designed to treat all kinds of automobile parts and consists of a 200-kw. hardening furnace, a motor-operated quench, and a 200-kw. drawing-furnace. A 200-kw. Baily annealing furnace is being installed at the Springfield plant of the Ohio Steel Foundries Co. and a similar outfit but with 300 kw. electrical capacity has been ordered for export to The Oddehome Steel Corporation of Norway.

Through a misunderstanding, the office of **J. R. Davies**, Los Angeles representative of **A. S. Lindstrom**, was given on page 444 of our October issue as 121 Second street, when it should have been 121 East Sixth street. Besides the companies listed in our October issue, Mr. Davies also represents the Mercury Manufacturing Co., industrial storage-battery tractors and trailers; Packard Electric Co., transformers and electric rim-heaters; National Metal Edge Box Co., box-making machines; Magnetic Manufacturing Co., magnetic separators; and O. S. Walker Co., magnetic chucks and grinding-machines.

The 19th annual convention of the **National Machine Tool Builders' Association** was held at the Hotel Astor, New York, November 11-12. Addresses were delivered by D. R. Weedon, of the Westinghouse Electric & Manufacturing Co., on 'Standardization', Francis H. Sisson, of the Guaranty Trust Co., on 'Financial Conditions as Affecting Business', and by W. R. Montgomery, attorney for the National Association of Credit Men, on 'Cancellation of Orders'. This latter address probably evoked the greatest interest, particularly Mr. Montgomery's exposition of the way in which certain lax ways of doing business frequently made legal enforcement of sales contracts impossible, and left the seller no recourse against cancellation. The spring meeting of the Association will be held at Atlantic City, New Jersey.

Increased capacity, necessitated by increased volume of business, has recently been secured at the **W. H. Jahns** piston-manufacturing plant at Los Angeles and further expansion is planned in the near future. With the intention of constructing a large addition to his foundry, Mr. Jahns has purchased an acre of ground adjoining the present building. A new siding connecting with the Santa Fe main-line tracks has also been obtained to facilitate shipping. One of the latest improvements, now in operation, is a new five-ton cupola, which has made possible an increased output, 1400 pistons being cast three times per week. The capacity of the Jahns factory today is 700 semi-finished pistons per day, as compared with 150 per day a few years ago. The business has been established eight years, being started in 1912 in a small building on West Pico street. A little more than a year ago, the plant was moved to its present situation in the northern part of Los Angeles.

The directors of the **Steel Mill & Foundry Supply Co.**, 503 Market street, San Francisco, organization of which was noted in our November issue, are C. P. Burgess, of the Pacific Coast Steel Co.; W. L. Booth, of the Judson Manufacturing Co.; D. H. Botchford, of the Columbia Steel Co.; Reese Llewellyn, of the Llewellyn Iron Works; and A. C. Denman, Jr., of the Southern California Iron & Steel Co. **I. L. Ward**, formerly purchasing agent for the Pacific Electric Railway Co., Pacific Fruit Express Co., and Southern Pacific Land Co., has been appointed general manager, and **W. A. Letcher**, formerly vice-president of the Northwestern Steel & Metal Products, Inc., of Seattle, is secretary and treasurer. The company will deal in scrap iron and steel, pig-iron, coke, ferro-alloys, and refractories for rolling-mill and foundry use. Yards will be established at Oakland, South San Francisco, and Los Angeles.

Formal announcement has been made by the **Berger & Carter Co.** of the formation of the **Berger, Fleming & Brown Co.**, manufacturing machinery for canners and dried-fruit packers, a $5,000,000 corporation with main offices and factories at San Jose. The new corporation absorbs the following companies: The **B & C Machinery Co.**, which has maintained a factory for the manufacture of canning machinery at Hayward for several years, and which has all along been controlled by the Berger & Carter interests. The **Wonder Dehydrator Co.**, of San Francisco, manufacturing 'Wonder' portable and custom dehydrators under the Hammond Process patents. The **National Axle Corporation**, whose plant for the manufacture of automobile-truck axles at San Jose is nearing completion. The **Smith Manufacturing Co.**, whose plant for the manufacture of machinery and equipment for dried-fruit packers has been in operation at San Jose since 1902. The factory equipment of the B & C Machinery Co. will be moved to the plant of the Smith Manufacturing Co., and a new unit will be added to the plant of the National Axle Corporation to handle the manufacture of dehydrators. The officers of the Berger, Fleming & Brown Co. are Otto A. Berger, chairman of the board of directors; W. W. Fleming, president and general manager; and E. W. Brown, vice-president and treasurer. These same men hold practically corresponding positions in the Berger & Carter Company.

The Standard Oil Co. has added to its fleet, the motorship 'Charlie Watson'. This vessel is the first steel motorship to be built on the Pacific Coast, and the first motorship tanker built in the United States. The vessel is built for service in Alaskan waters, and is especially designed to meet Arctic conditions. The electric equipment is probably more up-to-date and complete than that of any vessel now operating on the Coast. The vessel is outfitted with an electric-siren fog-signal; the newly perfected Butler electric sounding machine; the Magnavox marine telephone; and various other new and interesting devices designed for the safety and convenience of the crew. All auxiliary machinery is electrically driven from two 100-kw. General Electric generators direct-connected to two 150-hp. Dow three-cylinder Diesel engines. Because of the fact that the vessel carries high explosive oils there will be no fires aboard, and all cooking will be done by electrically operated ranges, water-heaters, etc. The staterooms and quarters are also electrically heated, so as to avoid any possibility of a fire at sea. The 'Charlie Watson' is equipped with twin Diesel engines, developing 550-hp. each, and direct-connected to the twin propellers. When fully loaded and under full power, the ship will make 11 knots per hour with less than one-third of the fuel required for a steam-equipped vessel. The vessel is a Pacific Coast product. She was built by the Union Construction Co., of Oakland, and the principal items of her equipment were furnished by Pacific Coast firms. The engines were built at Oakland by the Skandia Pacific Oil Engine Co.

OBITUARY

Arthur E. Hauck, president of the Hauck Manufacturing Co., manufacturers of oil-burning appliances, kerosene torches, furnaces, forges, Brooklyn, New York, died at his home in Brooklyn, October 30, aged 41. Mr. Hauck started in the oil burner business in 1902 with a small shop in Brooklyn. His pioneer work was the basis for much of the industrial oil-burning of today.

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